The Electrical Industry's Weekly Magazine

February 27, 1961

Electrical World

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ANNUAL STATISTICAL REPORT

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Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

FEBRUARY 27, 1961

Vol. 155, No. 9

Electrical
What in the World . . .

Recently our editors have sensed an upturn of interest in residential electrical space heating. EW has pushed the subject hard since the days when it could hardly be termed popular with utilities, so we're gratified.

This week's news pages, for example, tell of a National Coal Policy Conference educational seminar which brought together many home building groups who previously hadn't been introduced properly to electric heat. We were proud to have John Damon, EW's "heating editor," on the program, which he says turned out to be an excellent affair.

And this week's selling section carries news of an electric house heating rate just issued by a major Eastern combination utility; this is good tidings indeed.

Our contacts with major appliance makers indicate a growing enthusiasm by them for the mass housing market and, more recently, the high-rise apartment market—for electric heating.

And so it goes, though it still goes too slowly.

To find out how fast it *is* going (we reported last on space heating growth in our Sept. 19, 1960, Forecast Issue, p 110), we've sent out another survey questionnaire to utilities, and we'll report back to you as soon as we can.

The next point: Should *Electrical World* hold its fifth Electric Space Heating Conference? Has the need passed? We're now probing past attendees for their thoughts, and to find out what should its approach be, should another be held. Any reader with strong opinions is invited to write the Editor now.

Chuck Hochgesang

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This new Quartzone® Electric Heater makes every bathroom modern. It's the logical luxury touch in new homes, a "must" in remodeling.

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You'll like the ease of installation; it goes in as easily as an ordinary fluorescent lighting fixture. Mount it on a standard outlet box either in the ceiling or on any wall. It tilts 20° to direct warmth where it's most wanted.

And forget about costly call-backs with this rugged unit. That sturdy Quartzone tube stands up to sudden temperature changes and won't crack even if water splashes on it. There's also a chrome guard to protect the tube and the highly polished reflector plate.

The new Electromode Quartzone Bathroom Heater comes in two models, 120 and 240 volts. Larger units are available for outdoor applications. For all the facts, contact your Electromode representative, or write to:

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Electrical World

Letters

'Line Hose' Involves 'Safety Practice'

To the Editor:

The name "line hose," which your New Product Editor chose to use in describing the new Hendrix Clip-on Line-Duc (EW, Jan. 23, p 24), could possibly lead to a misunderstanding. "Line hose" infers that the product could be used as a *line hose* for rubbering up preparations in hot line work.

Hendrix, in all its advertising bulletins, direct talks with utility people, etc. avoids such an inference. It is our policy not to suggest that it can be used as a line hose, since we do not want to become involved in the safety practices of any utility.

R. G. Raymond,
Sales Manager,
Hendrix Wire & Cable Corp

Puerto Rico Also Uses 'Copter for Toting

To the Editor:

In the caption under the . . . photographs (see EW, Dec. 5, '60, p 65; "Copter Totes 138-Kv Tower, H-Frames") the operation undertaken by the American Electric Power System is said to be "the first time that helicopters have been used in all phases of line construction in the US."

We would like to point out that this statement is not accurate. Since the early part of 1959 the Puerto Rico Water Resources Authority has been using an S-58 Sikorsky helicopter in all phases of construction of 115-kv transmission lines. Within a period of 15 months . . . we completed construction of 76 miles of such lines involving the hauling and erection of 600 H-frames as well as the stringing of 500 MCM of aluminum steel reinforced conductors.

Practically all of this construction has been carried out over extremely rugged terrain across the mountains of Puerto Rico. Our helicopter has been used also in the construction of distribution lines in connection with rural electrification projects.

Justo Morales,
Power Design & Construction Technical Assistant & Advisor,
Puerto Rico Water Resources Authority

Dateline . . .

Washington—Long-awaited uniform site criteria to guide the locating and safety evaluation of future nuclear power and test reactors have been issued by the Atomic Energy Commission.

Their issuance—for public comment and reaction—is the beginning of a way out of the site-selection snarl-up which had threatened realization of economic nuclear power. Safety questions over siting have resulted in delays, notably in Detroit Edison's Enrico Fermi fast breeder reactor, and Experimental Low Process Heat Reactor for sea water conversion, and Small Size Pressurized Water Reactor projects for which Jamestown, N. Y., and Dairyland Power Cooperative, Wis., are still seeking site approval.

AEC's criteria, as would be expected in this early period of the reactor safety evaluation development, do not detail exact values for all the many variables involved in evaluation of reactor locations. They do not provide the precise solutions for unique conditions that particular cases may bring, say, for example, hazards linked with an industrial area Commonwealth Edison would develop next to its Dresden site.

To offset this lack of precision, the Commission assisted by ACRS will continue to exercise a certain amount of policy judgment to settle cases involving developmental reactors and cases for which substantial experience has not built up.

But the importance of the new criteria is not overshadowed by the absence of an absolute rule for calculating safe reactor locations. The fundamentally significant fact is that utilities for the first time have general standards to guide their own preselection of sites.

Says one long-time Washington consultant for nuclear power construction:

(*Continued on page* 71)

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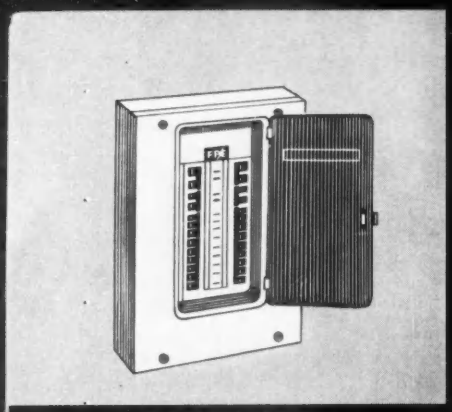

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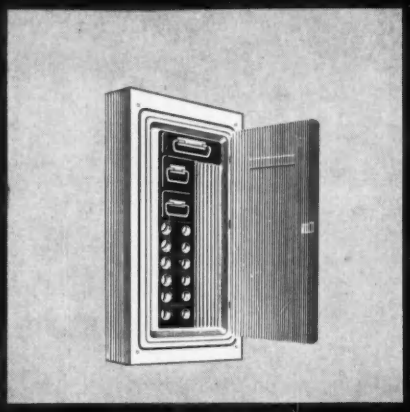
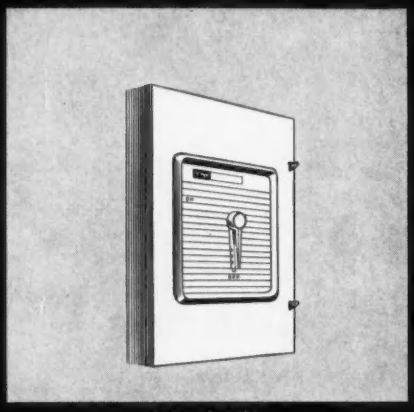
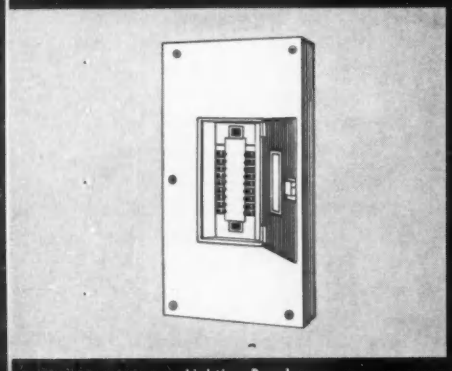


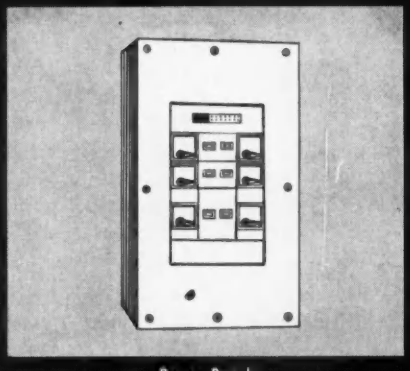
SF Fusible Load Centers



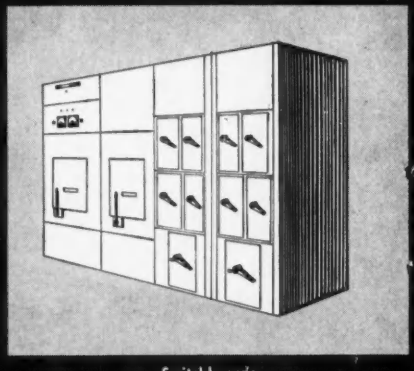
Safety Switches



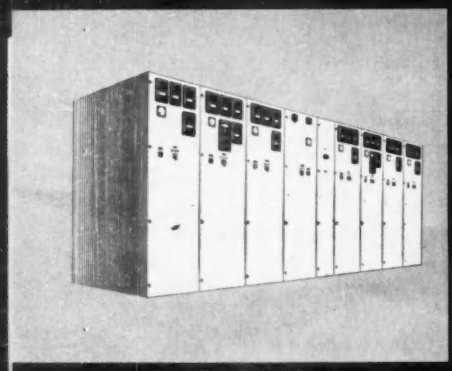
Lighting Panels



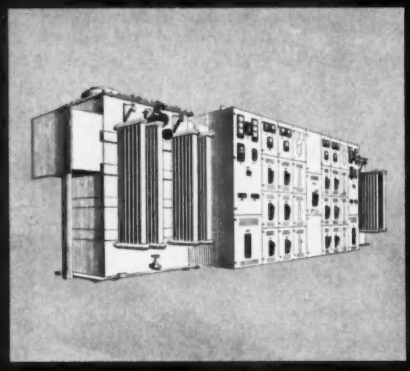
Power Panels



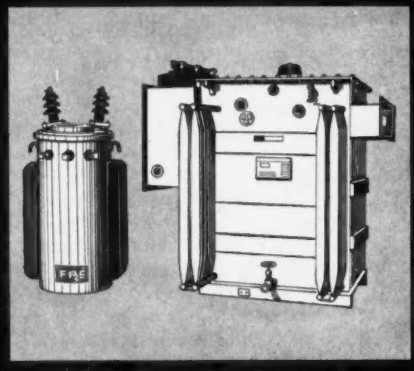
Switchboards



Metal-Clad HV Switchgear



Unit Substations



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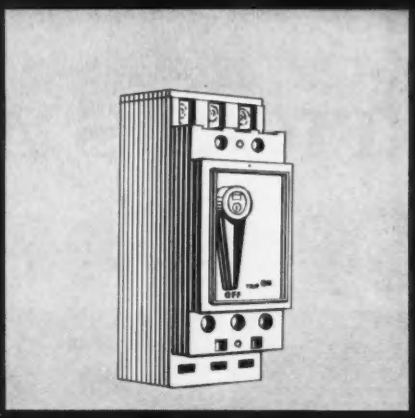
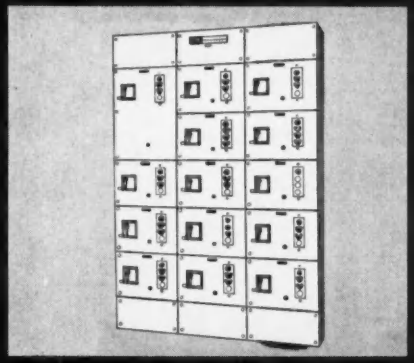
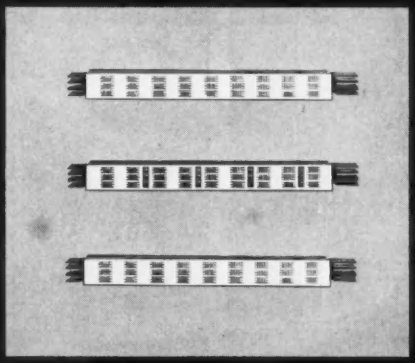


Rotary Handle Breakers

Motor Controls



Motor Control Centers



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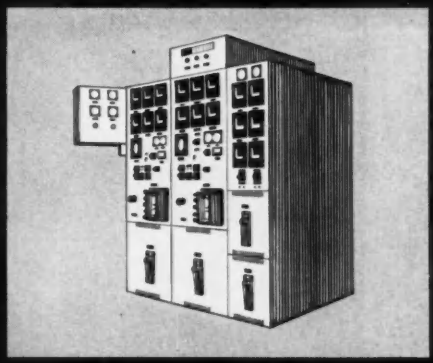

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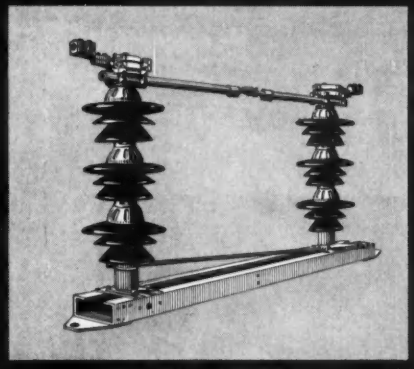
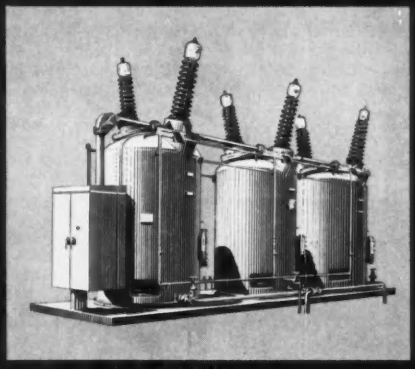


Power Disconnect Switches



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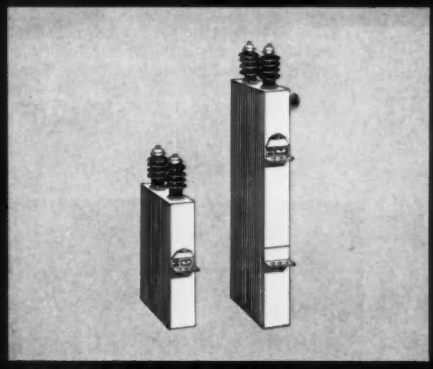

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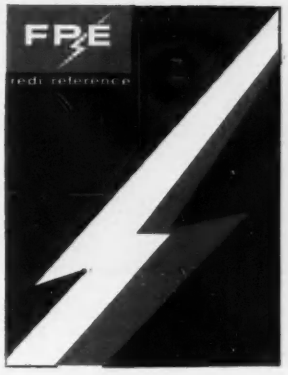

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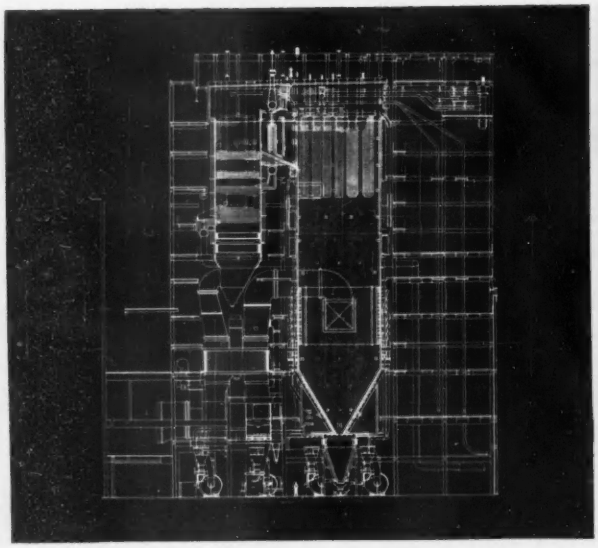
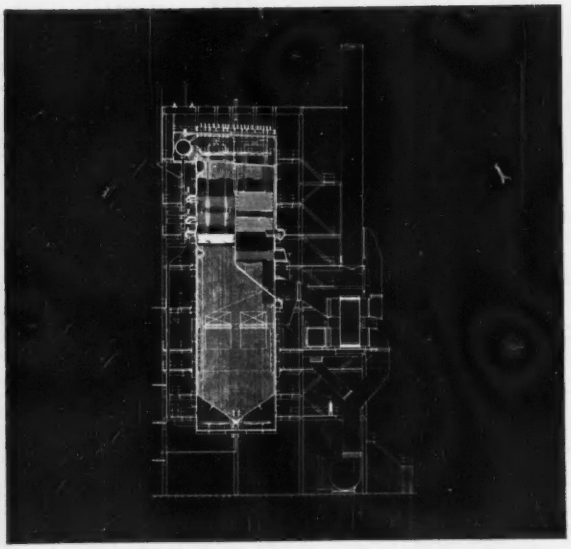
COMBUSTION'S ANNUAL

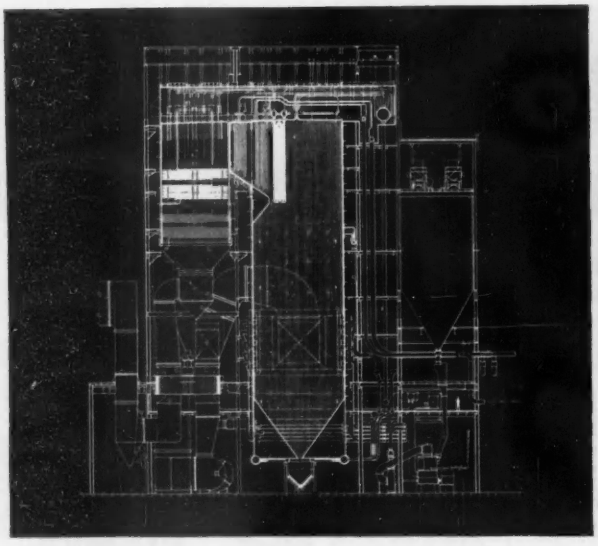
A REPRESENTATIVE CROSS SECTION OF 1960 C-E INSTALLATIONS



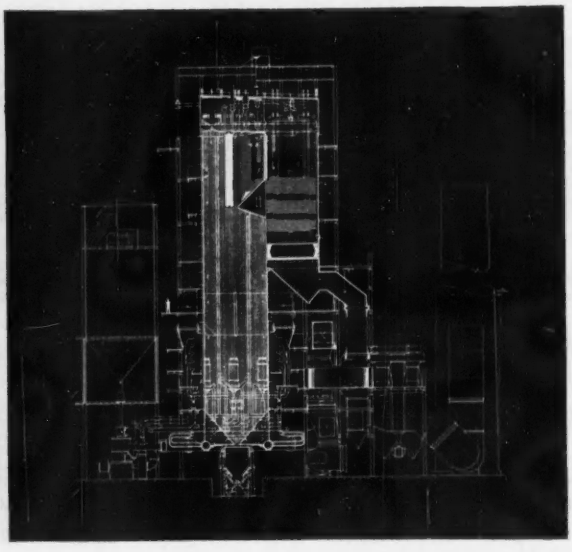
This pulverized coal fired C-E Sulzer Monotube Steam Generator went into service in 1960, at the Eddystone Station of Philadelphia Electric Company. The 325-mw unit is designed to provide steam at 5000 psi with superheat and reheat temperatures of 1200F/1050F/1050F.



This 110-mw unit went into operation at the Ocotillo Steam Electric Station of Arizona Public Service Company. It is a C-E radiant reheat boiler, fired by natural gas and oil, and produces steam at 1925 psi. Superheat and reheat temperatures are 1005F/1005F.



A 500-mw unit was placed in service at the Widows Creek Station of the Tennessee Valley Authority in 1960. It is a C-E Controlled Circulation, radiant reheat boiler, pulverized coal fired, producing steam at 2450 psi. Superheat and reheat temperatures are 1053F/1003F.



This C-E Controlled Circulation, radiant reheat boiler was placed in service at Montrose Steam Electric Station of Kansas City Power & Light Company in 1960. The 156-mw unit, fired by pulverized coal, produces steam at 1925 psi. with superheat and reheat temperatures of 1005F/1005F.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS;

STATISTICAL REPORT

In 1960, the electric utility industry placed in service about 10,800 megawatts of new thermal generating capacity.* C-E's contribution to this total was 4,678 megawatts and included two noteworthy firsts. One, a C-E Controlled Circulation unit is the world's first boiler to serve a 500 megawatt turbine-generator. The other represents the most advanced power plant cycle yet attempted. It is a C-E Sulzer Monotube Steam Generator designed to deliver 1200F steam at a pressure of 5000 psi to a 325 megawatt turbine-generator. Both of these units were placed in commercial operation in 1960.

During the year, the electric utility industry ordered approximately 3,700 megawatts of new boiler capacity from C-E. Over 80% of this total is to be served by C-E Controlled Circulation Boilers. More than 60% of the total capacity ordered is for turbine throttle operation of 2400 psi and above. C-E's 1960 order board shows a total of 5 units with capacities of 300 mw and above, including one 500 mw unit.

*Source: "Electrical World"

THE C-E CONTROLLED CIRCULATION STORY

Total capacity ordered, as of year-end 1960	26,300 mw
Total capacity in service, as of year-end 1960	16,421 mw
Capacity ordered in 1960	3,055 mw
Capacity placed in service in 1960	3,108 mw

THE C-E 2400 PSI STORY

Total capacity ordered, as of year-end 1960	12,185 mw
Total capacity in service, as of year-end 1960	6,093 mw
Capacity ordered in 1960	2,250 mw
Capacity placed in service in 1960	2,266 mw

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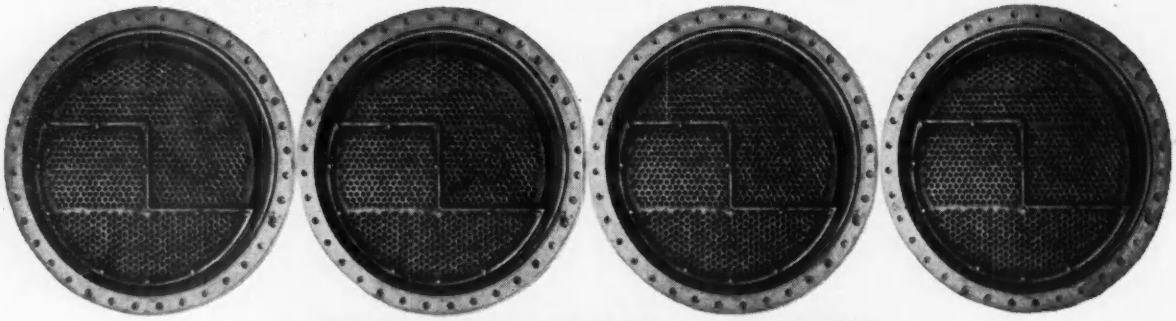
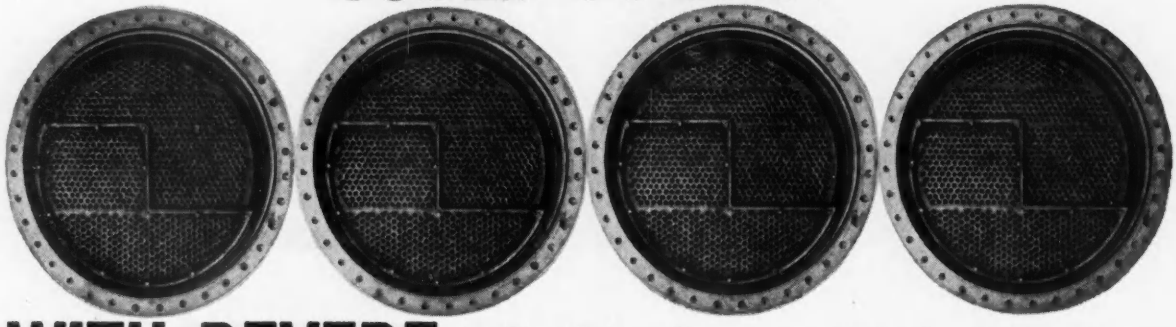


"TUBED TO LAST"



WITH REVERE 70/30 Cupro-Nickel Tubes

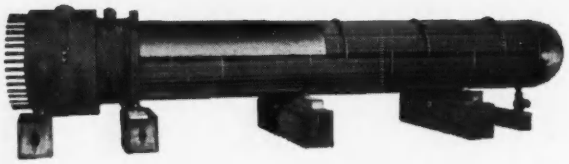
These Units for Cherokee Station Unit #2 of Public Service Company of Colorado were fabricated by YUBA Heat Transfer Division, YUBA Consolidated Industries, Inc., Honesdale, Pa.

Because there are so few sets of operating conditions that are exactly alike, each tube installation poses its specific problem which must be studied before a satisfactory recommendation can be made. In this installation of 8 feed water heaters, the specific set of conditions called for dual gauge tubes of 70/30 Cupro-Nickel. Tubes of dual gauge were used in order that uniform wall thickness be maintained after bends had been made.

This selection was made as a result of the collaboration of YUBA Engineers and Revere's Technical Advisory Service. It is this Revere Service, with its experience covering many and varied types of problems, that has been instrumental in prolonging tube life in power plants both large and small.

Why not take advantage of this storehouse of knowledge and contact Revere before making the final selection of tubes and plates for your equipment?

8 TUBE BUNDLES like this consumed 47,000 lbs. of Revere 70/30 Cupro-Nickel Dual Gauge Tubes.



REVERE COPPER AND BRASS INCORPORATED

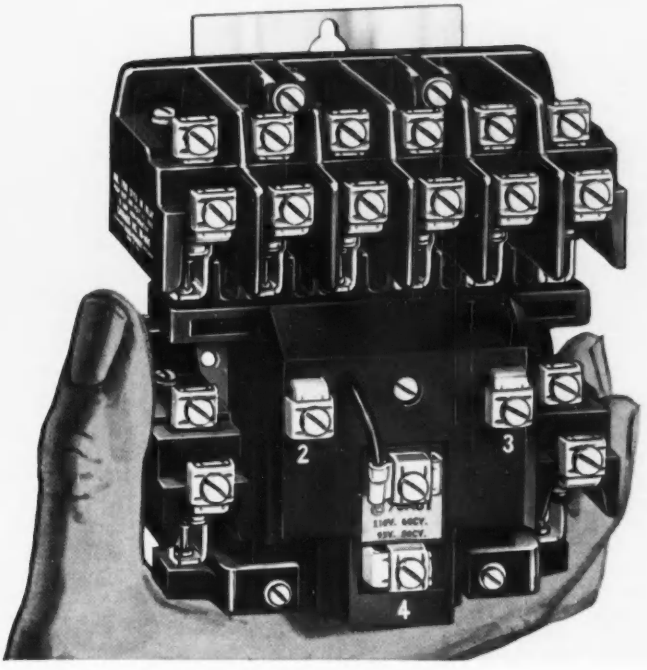
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md.; Chicago, and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.

INTEGRAL FINNED TUBE • BIMETAL TUBE • DUAL GAUGE TUBE • INSTRUMENTATION TUBE • CONDENSER TUBES IN CUPRO-NICKEL, ALUMINUM BRASS, ADMIRALTY, HERCULOY, ARSENICAL COPPER, MUNTZ METAL AND OTHER ALLOYS • ALUMINUM TUBE, SHEET AND EXTRUSIONS • SMALL AND LARGE PLATES IN CUPRO-NICKEL, COPPER, HERCULOY, MUNTZ METAL, NAVAL BRASS AND ADMIRALTY.

NEW Allen-Bradley Relay with EXCLUSIVE Permanent Magnet Latching



Saves Panel Space

Gives Millions of Trouble Free Operations

Holds Closed Without Coil Current

Two to Six Poles

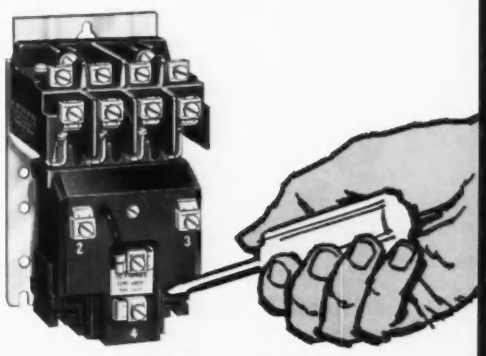
Bulletin 700 TYPE BRM

Here's a completely new "latching" relay—which does not use a mechanical latch! It is the Bulletin 700 Type BRM—built to provide the same millions of dependable operations you get from all Allen-Bradley's industrial relays. A "built-in" permanent magnet eliminates the mechanical latch and the usual troubles caused by mechanical linkages.

When the coil of the new Bulletin 700 Type BRM relay is energized, the relay closes and is held closed after the coil circuit is opened—by a permanent magnet. Energizing the coil in opposition to the permanent magnet field opens the relay. The correct polarity for operation of the relay is obtained from silicon diodes held within the molded coil cover. With no "piggy-back" additions out in front, and no "extra" solenoids below, the Type BRM relay saves valuable panel space.

These A-B Type BRM relays also feature a continuous duty coil that permits the current to be left on, if desired. As with all Allen-Bradley relays, the double break, silver contacts never need attention. And the contacts of these new magnetically latched relays afford the same 60-second convertibility of the popular Bulletin 700 Type BR relay.

For latching relay service, it will pay you to investigate this new and completely different relay. It provides the usual Allen-Bradley quality!



Can be latched or unlatched by hand

ALLEN-BRADLEY

Member of NEMA

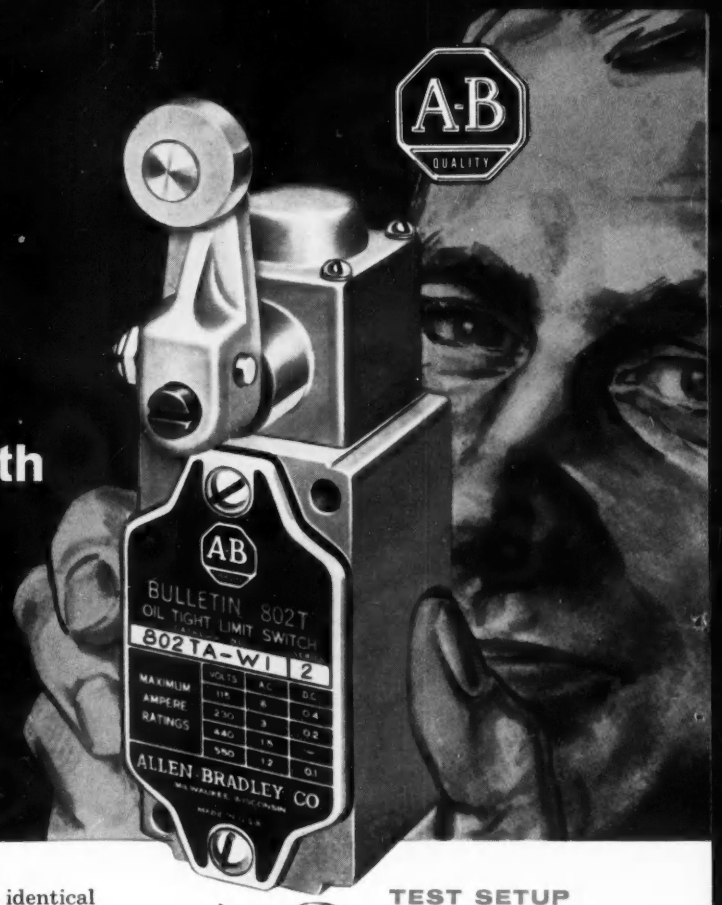
Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

8-61-RM

Only ALLEN-BRADLEY LIMIT SWITCHES FINISHED TEST with *NO FAILURES!*

...and remained good for many more millions of trouble free operations

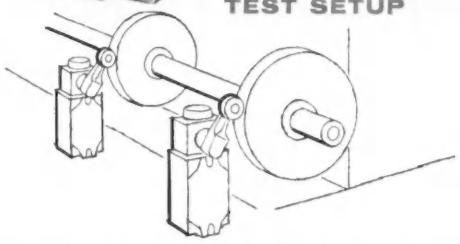


Recently, a large user of limit switches selected two identical units from each of five leading manufacturers and subjected them to the same accelerated life test. When the test was stopped after many, many millions of operations, only Allen-Bradley Bulletin 802T oiltight limit switches were left *with no failures!* Also, a careful inspection of these two Bulletin 802T limit switches suggested that they were still good for *many more millions* of operations.

The Allen-Bradley "built-in" quality is the reason for such unmatched performance. With switch bodies and operating heads positively sealed against oil and dirt, A-B Bulletin 802T limit switches are free from contact fouling and sluggish operation. The precision switch mechanism has a positive snap action—it is impossible for vibration to cause contact chatter. The double break, silver contacts never need servicing.

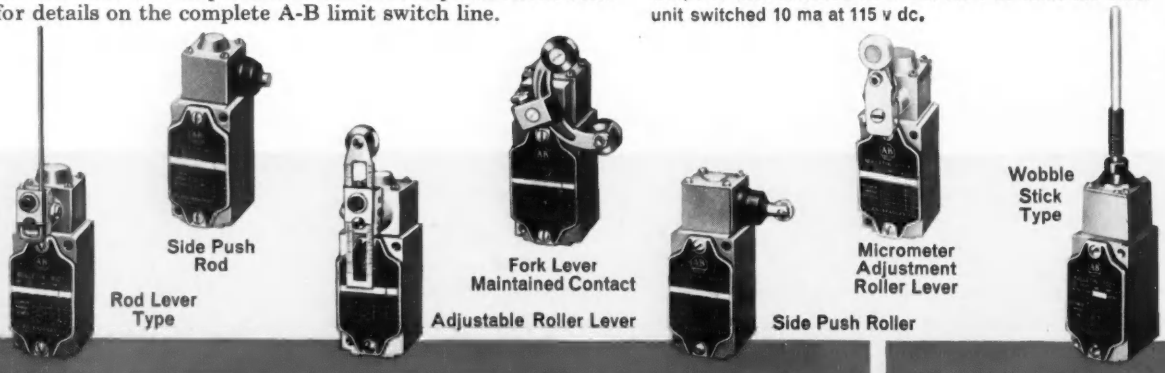
Insist on Allen-Bradley Bulletin 802T oiltight limit switches—they will *always* provide you with the long, trouble free life that is so important to continuous production. Send for details on the complete A-B limit switch line.

TEST SETUP



Purchased through regular supply channels . . .

and tested under identical conditions, insuring an impartial evaluation of performance. Of the ten limit switches tested (two each of five different makes), only three were operating when the test was stopped. Two were A-B Bulletin 802T switches and one of another make, of which the second unit had failed early in the test. On this accelerated life test, one unit switched 1.0 ma at 115 v dc while the other unit switched 10 ma at 115 v dc.



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QUALITY MOTOR CONTROL

6-61-RM

Electrical World

FEBRUARY 27, 1961
Vol. 155, No. 9

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DON'T MISS *Electrical World's* special report on AIEE's winter general meeting.

The Electrical Week

LATE NEWS ▶

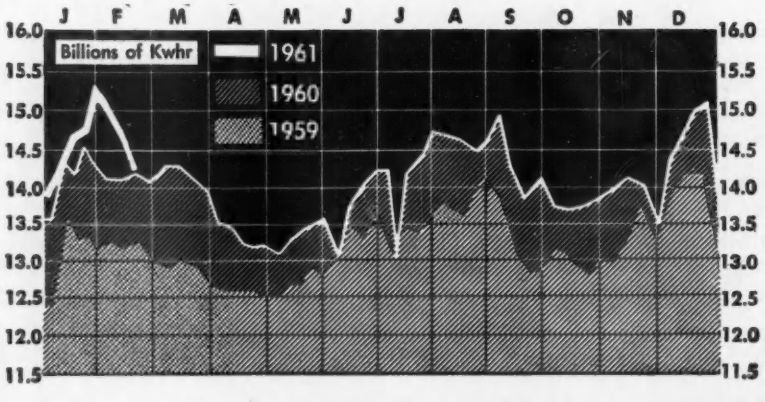
Storm trouble—Freezing rainfall keeps 185 crewmen on round-the-clock duty restoring service to 18,000 customers of Iowa Power & Light. Crews were borrowed from Kansas City, St. Joseph, Iowa-Illinois and Iowa Public Service. Virtually all trouble caused by ice-laden falling branches. Storm swept through most of Midwest from Texas to Michigan, but Iowa P&L caught most utility damage.

Verbal clash—AEC 202 hearings open with verbal clash between AEC's Robert S. Wilson and Sen Clinton P. Anderson (D-N. M.) when Wilson describes 1960 as the year "the national nuclear power effort grew up." Anderson asks if he didn't mean it was the year "the national nuclear power effort gave up." Anderson pursues questioning until bringing out that Eisenhower budget for fiscal 1962 has no new federal reactor construction starts in it.

In the legislatures—Oklahoma lawmakers consider two bills that would attempt to control area competition between cooperatives and other utilities. One bill proposes that when an REA area is annexed by a city, the REA may stay in business if it pays a franchise tax. At present annexed areas come under the public service franchise holder in the city. The second bill would prohibit a public service company or REA from extending or offering service to a customer within 500 ft of a competing line . . . **Washington** state legislators write a bill that proposes a 3% utility tax on home-metered electric and gas service, as well as home-delivered heating oil. This would be in addition to state taxes of 3.6% (electric) and 2.4% (gas) already levied against utilities . . . **Indiana** bills would allow cities and towns to impose a tax of up to 10% on utility bills; would ease municipal takeover by requiring only a two-thirds majority of voters on referendums instead of two-thirds of total registered voters . . . **Kansas** utilities are fighting legislation to make original cost of equipment less depreciation the basis for determining utility rates . . . **Ohio** faces similar legislation if Gov Michael DiSalle has his way in getting present reproduction cost new less depreciation formula upset.

Stalemate—British Columbia's provincial government succeeds in delaying Upper Columbia agreement with Canadian government with studies by B. C. Energy Board and five consulting engineering firms retained by B. C. Power Commission. Provincial government will not negotiate with federal government until studies are complete. Peace River developers, expecting to sign contracts for power sales this month, are bogged down with potential customers (including B. C. Electric Co) who are holding off until Upper Columbia decisions are made.

WEEKLY POWER OUTPUT—Down 0.1% (Week ending Feb. 18), Kwhr 14,315,000,000



Per Cent Change From Previous Year

	Feb. 4	Feb. 11	Feb. 18
Total U. S.....	+ 6.1	+ 4.0	— 0.1
New Eng.	+10.2	+ 5.4	+ 5.3
Mid. Atlan.....	+ 8.6	+ 5.3	+ 3.3
Cent. Indust ...	+ 0.2	— 2.4	— 5.6
West Cent.....	+ 8.5	+ 5.3	+ 2.0
Southeast	+ 9.6	+ 7.5	— 3.8
South Cent....	+ 5.9	+ 7.3	+ 3.3
Rocky Mount...	+13.4	+13.2	+11.0
Pacific			
NW	+ 6.1	+ 3.1	+ 3.0
SW	+ 4.6	+ 5.2	+ 7.4

Seasonally Adjusted Index 270

Week Ago 278 Year Ago 266

Source: Edison Electric Institute

Supply Lines

GE STILL DIGGING OUT FACTS ON DAMAGES, MINIMIZES SUMS INVOLVED

"What happened to me, the utility buyer?" is the question General Electric Co hopes to answer when it sits down with utility customers to discuss possible damages as a result of the antitrust cases. In an interview last week, Charles E. Wilson, former GE president who has been called back to handle the voluntary studies with customers, told *Electrical World* he was still busy marshalling the facts together and would not be ready to sit down to talk with customers on a factual basis for at least "a couple of weeks." "Just to get the bare facts is a big-scale job," Wilson stressed, and included as part of these: the actual transactions on the equipment involved, the prices prevailing at the time, and the material and labor cost increases over the years.

Evidently, the manufacturing industry's record of increased costs will serve as a backdrop for the negotiations, but the actual assessing of possible damages will be based more on market conditions at the time. "Although he should, the customer is not interested in whether we made or lost money," Wilson noted. "He wants to know whether he paid an alleged conspiratorial price, and whether or not it was a good buy." On the basis of the studies he has made so far into the record, Wilson says he does not believe utilities have been damaged much, if at all, and notes that even though list prices may have been fixed by a conspiracy, the actual selling prices were for the most part settled in the market place.

Wilson emphasized that there were many questions yet to be answered. For instance, right now he is concentrating on equipment involved in only the six cases where GE pleaded guilty; he did not know whether eventually the voluntary studies would deal with the other 13 cases in which GE pleaded *nolo contendere*. In addition, although GE is working with an outside accounting firm hired jointly with Westinghouse Electric Corp and Allis-Chalmers Manufacturing Co, Wilson did not know whether contacts with customers would be made by each of the three companies, or on a joint three-company basis. The point Wilson stressed is that his main concern has been and still is to get the facts on the matter first, and to worry about procedure later.

In the meantime, in the face of a mounting attack from the public and from customers saying they will sue for millions and millions of dollars, GE has itself taken on a public relations offensive. Two weeks ago it released to the press a previously confidential internal memo detailing its side of the long period of negotiations with the government which culminated in the six guilty and 13 *nolo contendere* pleas in the antitrusts suits.

A week and a half ago, Ralph Cordiner, chairman of the board of GE, went before the New York Security Analysts Society and emphasized repeatedly that GE was not going to pay to customers the vast sums being quoted in the press. For one thing, Cordiner noted, the GE sales involved in the guilty pleas amounted to between $1.2 and $1.5 billion total, but that some years ago, when GE was sued for some $100 million in a similar case, it eventually had to pay only $1.4 million. Cordiner stressed that the voluntary studies will show customers hadn't been damaged, but if they had, GE would be glad to settle. And he noted that if damage suits were instituted, GE would resist them vigorously.

And last week, GE issued to the press a report entitled "Antitrust Damages: Facts in Place of Speculation." This report discusses the general price trends of electrical and other machinery during the period of the conspiracies and relates these

trends to wages, productivity, and material costs. In conclusion, the report states:

"Thus, even on the basis of preliminary data, we can already see the rashness of any general speculation as to financial detriment suffered by utility customers. We sincerely believe that our policy of sitting down with those customers to review the applicable facts will prove to be the soundest approach. If such a customer feels, after such a meeting, that no acceptable solution has been offered, he still has the right and privilege of instituting a damage suit."

PROPOSED COPPER CARTEL WOULD MEET US PRODUCER OPPOSITION

Despite a weak copper market, US copper producers are generally against setting up a world-wide copper cartel to stabilize the industry's prices and production. The cartel plan was proposed recently by Senate Majority Leader Mike Mansfield (D-Mont.) "to encourage production on a year-round basis, and thereby to bring security to those of our people who are dependent upon copper for a livelihood."

The Administration will study Mansfield's proposal, not only because of his position as Senate leader, but also because commodity agreements (which are, in effect, similar to cartels) are getting a new look as a possible innovation in US trade policy. Such agreements have been recommended by President Kennedy in a Senate staff study on foreign trade policy and, reportedly, in a private report by Adlai Stevenson and George Ball, now under secretary of state. Until now, the US has backed away from most commodity agreements, including tin and coffee; only wheat and cotton agreements have involved the US.

While a copper agreement or cartel would probably raise prices in a weak market, the majority of US producers say they are opposed to such a plan. For one thing, they are fearful of the regulation that would be entailed, including regulation of wages, prices, production, and who could trade with whom. They also say the plan, by eliminating competition, would inhibit the growth and efficiency of the industry. But there are a few in the industry who would favor the plan. It is considered doubtful whether their voices will be loud enough.

GOOD PORTION OF ARRESTER/CUTOUT BUSINESS AT BOOK, FIRMS SAY

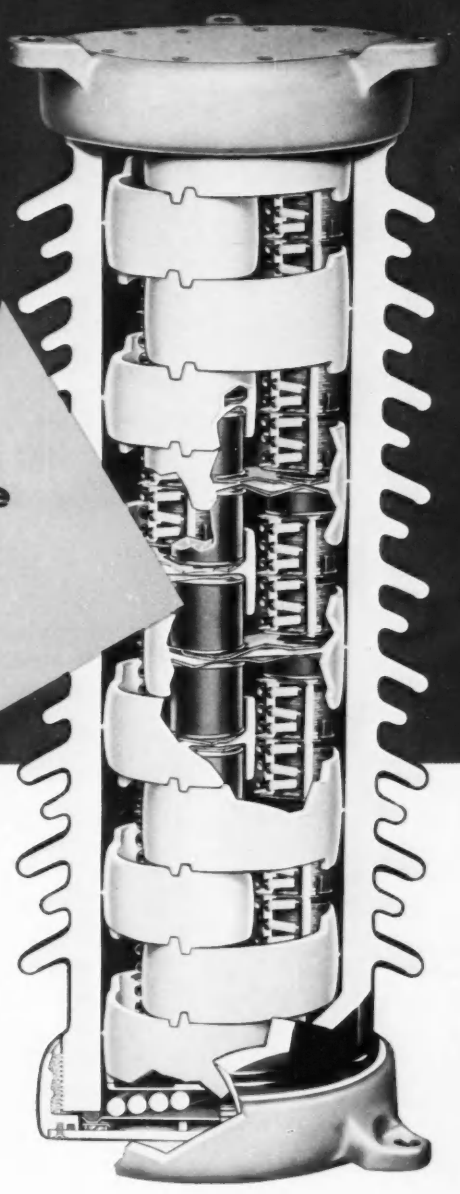
Midwest arrester and cutout manufacturers indicate they received a substantial proportion of their 1960 business at book or published prices. *Electrical World* queried these manufacturers and received the following response:

One manufacturer said that more than two-thirds of its fuse cutout and lightning arrester business was obtained at published prices. Another, S&C Electric Co, said 100% of its business in fuse cutouts and power fuses was done at published prices, but noted it had to drop its box cutout published prices to meet competition in February, 1960.

And another firm said that on a conservative basis, 53% of its domestic cutout/arrester business was at book. Still another said that 75% of their lightning arrester business was at book, but added that while the market was generally uniform for most of the year, it had noticed a deterioration in the price trend during the past two months. On its cutout business, the same firm said about one-third of it had been done at book, and noted a soft-price situation throughout 1960 with no improvement during the past two months. Two other manufacturers queried said they could not dig out the data.

Tops in station protection

Better arrester valve block use establishes easier passage of lightning surges



Thorex Dynagap Station Class lightning arresters offer top grade protection for major station equipment. As evidence, check O-B catalog 37 for maximum IR discharge voltages -- the common industry measure of a lightning arrester's protective ability. These values are the lowest available from any station arrester.

Conventionally, valve blocks of silicon carbide provide most of the resistance to the 60-cycle follow current, but not in O-B's Thorex Dynagap arrester. More than 90 per cent of this resistance is produced by the Dynagap (O-B's current limiting gap).

Because of the lighter duty imposed on them, Thorex valve blocks are designed to offer less resistance to lightning surges and transients, permitting lower IR discharge voltages. This design is so successful that O-B is able to publish the lowest IR available . . . and the values are *absolute* maximums, too.

What does this mean for your station equipment? You can have protective margins that were unheard of only a few years ago . . . lower BIL ratings . . . and better protection for older equipment of questionable insulation strength.

Only Thorex Dynagap lightning arresters can give you this top protection. You can have it in your stations . . . at no premium in price.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass ® HOLAN

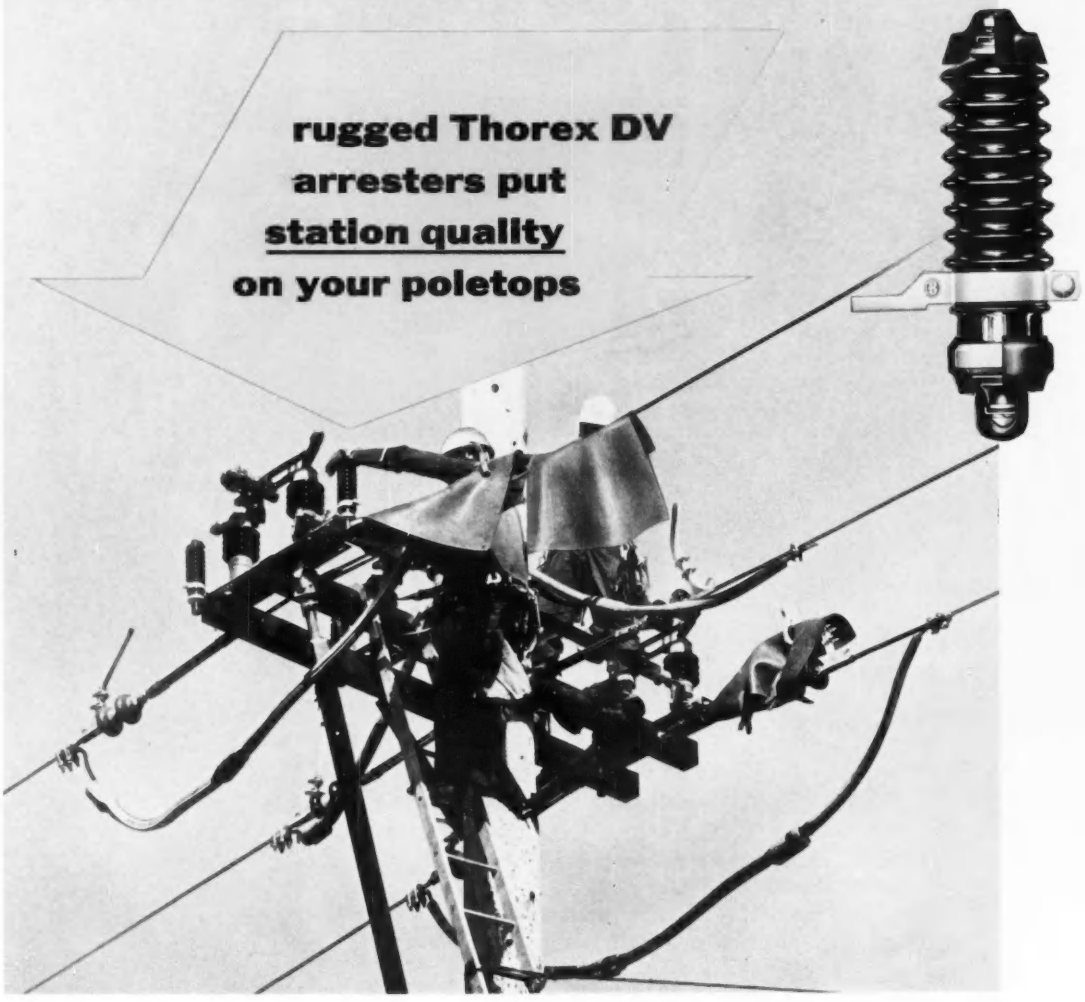
PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10110-H

for tops in distribution protection
SEE NEXT PAGE

Tops in distribution protection

rugged Thorex DV arresters put station quality on your poletops



Thorex Distribution Class lightning arresters bring essentials of station class performance to distribution systems. Used interchangeably in every class of Thorex lightning arresters, the Dynagap imparts dramatic benefits: (1) IR discharge voltage that is only slightly above some Station Class designs and (2) durability that is nearly 3 times better than ASA standard low-current, long-duration requirements for Station Class!

As in the Thorex Station Class arrester, Dynagap assumes much of the job of power-follow current limitation formerly handled by the valve block. Now free of this burden, the valve block has incorporated lower IR characteristics for better equipment protection and greater ability to withstand heavy surge discharges of long duration.

Thorex Dynagap DV arresters are tops in the degree of service and equipment protection they afford . . . and you can get this premium performance on your poletops just by specifying O-B Thorex Dynagap.

Four different models fit every line location: transformer mounted, line terminal connected with ground isolator, line lead connected with ground isolator, and line terminal connected with external air gap.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

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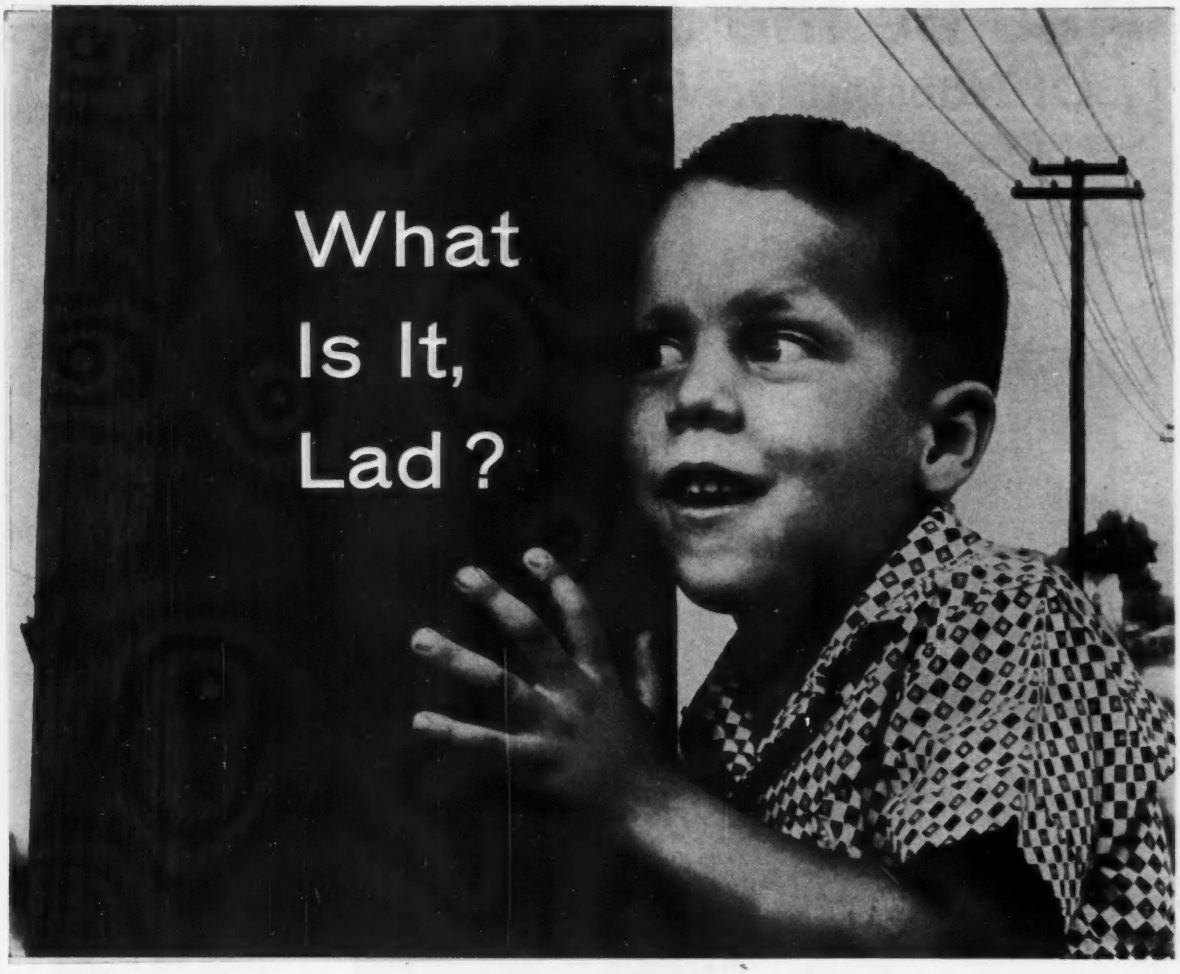


Westwinds Blowing Through Southwire

Every inquisitive boy has had his curiosity aroused by the hum of wind through wire. Today throughout the nation—west, north, east and south—when a boy places his ear to a utility pole, chances are he'll hear wind blowing through Southwire. Mile after mile of Southwire spans the nation—in high voltage electrical transmission lines, primary and secondary electrical distribution systems and telephone systems. Southwire began as a regional manufacturer just ten years ago. Today we have customers in 44 states and many foreign countries. Thanks to you and our other customers, Southwire has enjoyed a steady growth. We will strive to continue to merit your confidence in the years ahead.

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- Telephone Cable
- Machine Tool Wire

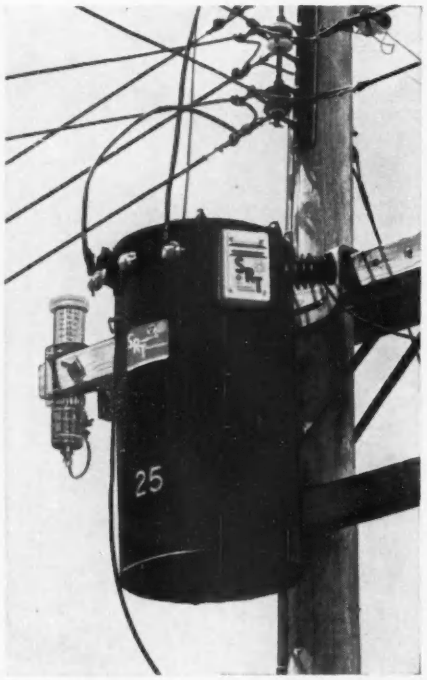
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

Southwire Company

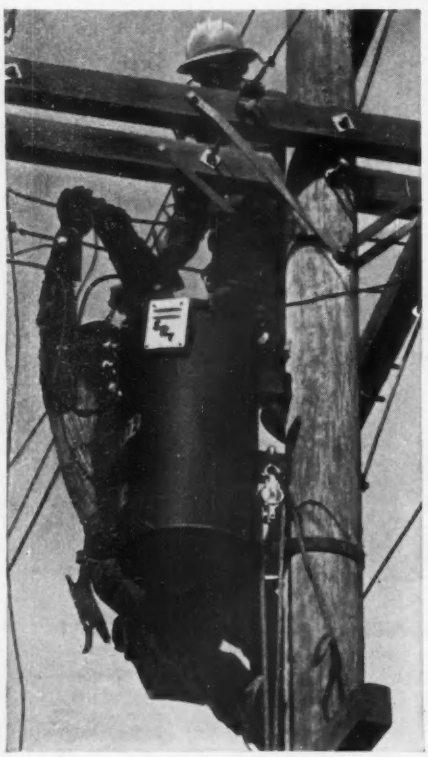
SOUTHWIRE serves the world

Carrollton, Georgia — TErrace 2-6311

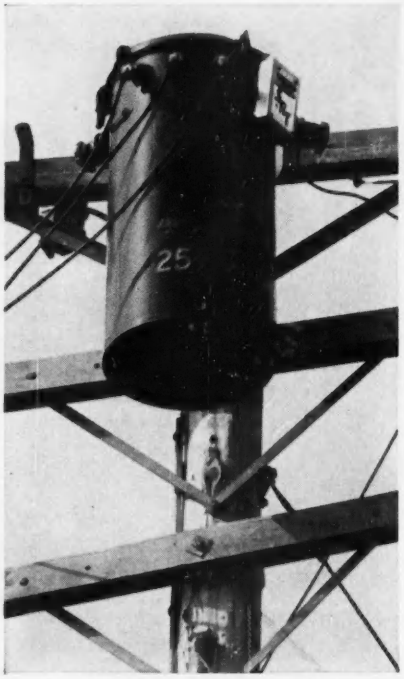
You Be the Judge
Of Transformer Values



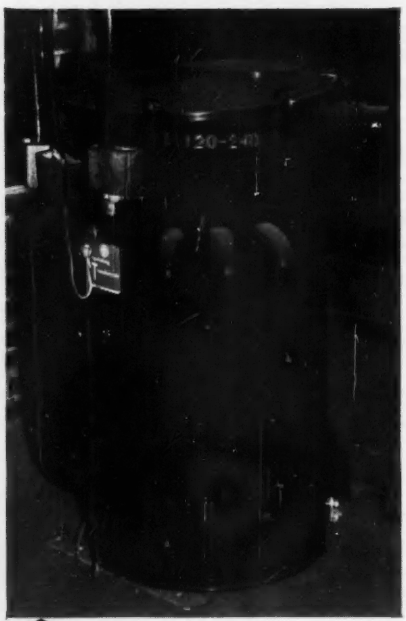
This 2400/4160 volt, 25 kva electronic SRT serves 20 lake cottages at Hillsdale, Michigan. While 10 of these cottages are fully occupied year-'round, the remaining 10 are occupied only on weekends at which time the secondary voltage varies from 118 to 126 volts. Although the line is served directly from the plant with no line regulation, the electronic SRT has maintained secondary voltage at 122 volts ± 1¾ volts.



Another electronic SRT being installed! This one, a 7620 volt, 25 kva unit on Public Service Company of Colorado lines, will serve a trailer park and resort area.

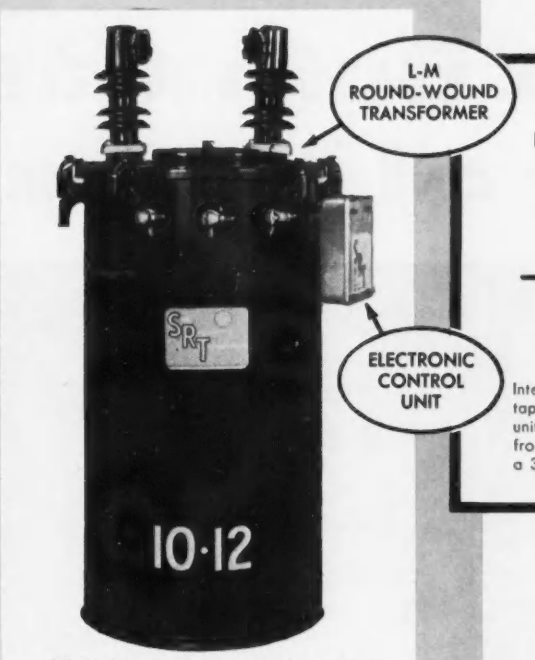


Sensitive electronic communication equipment, demanding a fairly even voltage level, is being supplied by this 4800 volt, 25 kva electronic SRT. Service has been completely satisfactory.

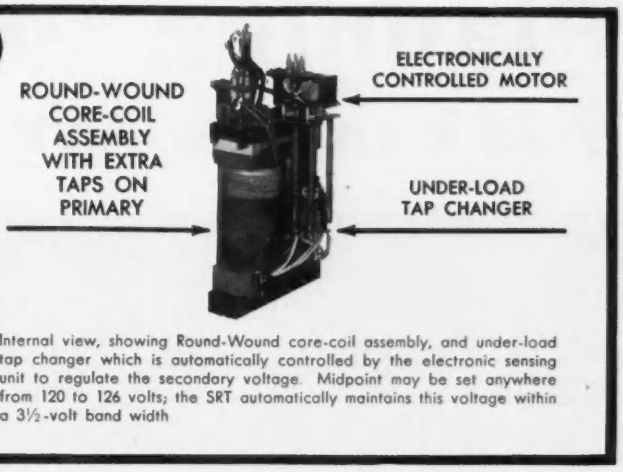


Cleveland Electric Illuminating Company uses this 37½ kva SRT in a vault to supply regulated 121 volt secondary power from a 4340-volt primary feeder. Although voltage on the primary varies from 4160 to 4500 volts, the SRT holds secondary voltage at the desired level selected.

Puget Sound Power & Light Co., has successfully used this 25 kva SRT for two years to supply regulated power to a remote Pacific Telephone & Telegraph Company microwave installation located high in the Cascade Mountains. Maintained voltage is 120 volts, plus or minus 1¾ volts.



SRT simply replaces conventional transformer where you have a regulation problem. It requires no extra pole space, no additional wiring. Note the new electronic unit—mounted externally where it is not affected by oil temperature changes, and is easily accessible for changing midpoint settings if desired.



Internal view, showing Round-Wound core-coil assembly, and under-load tap changer which is automatically controlled by the electronic sensing unit to regulate the secondary voltage. Midpoint may be set anywhere from 120 to 126 volts; the SRT automatically maintains this voltage within a 3½-volt band width

L-M's Electronic SRT®

Now in Full Production For Immediate Delivery

L-M's exclusive Self-Regulating Distribution Transformer fully tested in actual service for two years. Now new electronic control on the SRT® offers greater flexibility in the field, easier accessibility, longer expected life.

The Self-Regulating Transformer, developed by Line Material and put on the market in limited quantities two years ago, has been highly successful. By regulating right at the point of use, the SRT can solve both low-voltage and over-voltage problems and can provide better service for utility customers. Thus it greatly reduces customer complaints caused by voltage variations. Under most conditions, the SRT is the most economical means of voltage correction. In addition, extensive utility tests have proved the SRT reliable and efficient.

How the SRT Operates

The SRT requires no additional pole space, no extra wiring. Instead, the SRT contains, in one tank, a distribution transformer with extra taps on the primary, a regulating mechanism that is volt-sensitive on the secondary, and an automatically operated under-load tap changer on the primary. As secondary load fluctuates, the tap changer switches primary turns in or out to keep secondary voltage within a 3½-volt band width around a predetermined 120 to 126 volt midpoint.

Now With New, Field Tested Electronic Control

The SRT was originally equipped with a hydraulic operating unit that proved extremely dependable and accurate. Further work by L-M research engineers has resulted in an electronic solid state control that thorough field testing shows is not only exceedingly accurate, but also completely flexible. It may be adjusted to any desired mid-point voltage while the transformer is operating without the use of instruments.

Since the electronic unit is external to the tank, its components, therefore, are not affected by high oil temperatures associated with transformer loading. In addition, the total absence of moving parts assures life expectancy comparable to that of the transformer without need for periodic inspection.

Get Complete Details on SRT

Ask your L-M Field Engineer to show you reports from utility companies having extensive experience with the SRT, and details on its operation and application. Or write Line Material Industries, Milwaukee 1, Wisconsin.

YOU BE THE JUDGE OF SRT VALUE

Ask the L-M Field Engineer to present the evidence of value of the cool-running Round-Wound® Transformer, and the great new Electronic control. Then *you be the judge!*

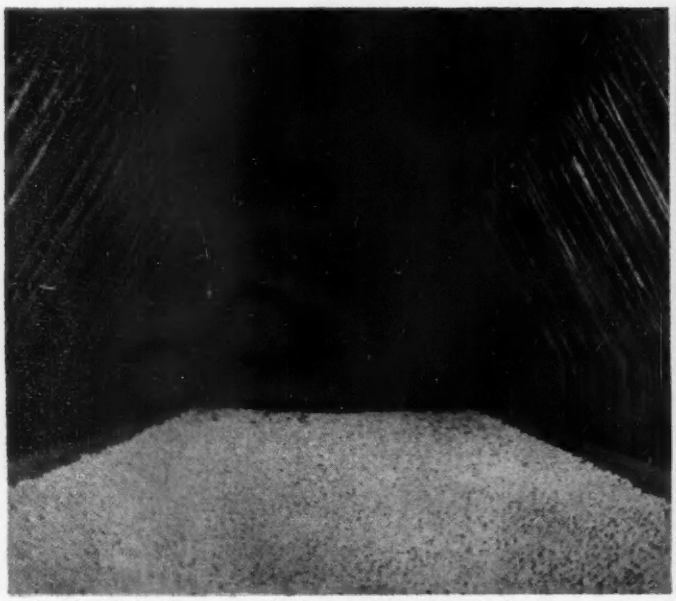
478

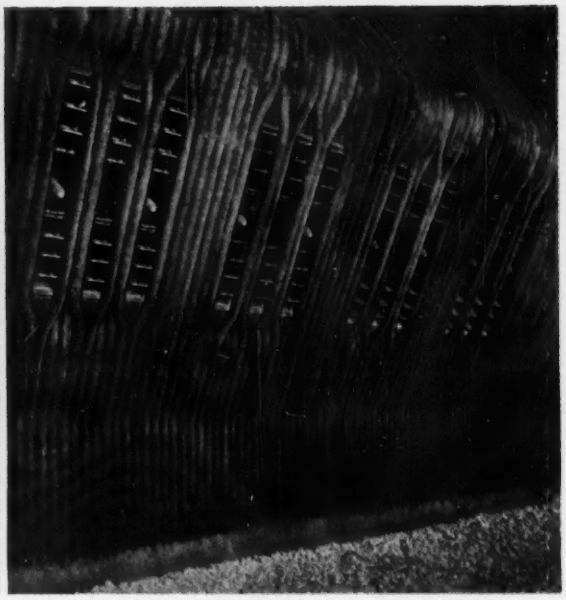
LINE MATERIAL® Industries
McGRAW-EDISON COMPANY
Distribution Transformers

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

Planning to Burn Gas,

You can fire *ANY ONE* or *ALL THREE*





Inside the Turbo Furnace at Sterlington Steam Electric Station of Louisiana Power and Light Co. Overall width 54′—7⅛″, depth 24′—0-3/16″. No. 1 firebrick rubble covers the furnace floor. Twenty Riley Directional Flame Burners are arranged for opposed firing on front and rear walls. Burners are shop fabricated assemblies. Burner close-up shows directional vanes, two

The Riley TURBO FURNACE unit is one of the major furnace design advances in recent years for the more efficient utilization of fuels. It is known as a multifuel unit primarily because of its ability to produce similar furnace exit gas temperatures with gas, oil, coal or other solid fuels. This phenomenum is due to the fact that natural gas, which ordinarily burns with a non-luminous flame, burns in a TURBO FURNACE with a luminous flame similar to oil and coal. In a TURBO FURNACE, fuels are burned with extremely high turbulence at the furnace bottom.

Much of the unusual combustion efficiency is due to opposed firing with Riley Directional Flame Burners specially designed for firing multiple fuels singly or in combination. These fuels may be pulverized coal, oil, gas, or other special solid fuels such as fluid coke or lignite.

Water Cooled Burner

The Riley Directional Flame Burner is designed for opposed firing on one level. Each Riley Directional Flame Burner is installed as a unit complete with water cooling tubes which are welded to the waterwall circulation system. The waterwall tube arrangement provides maximum cooling of directional vanes, nozzles and other burner parts and reduces to a minimum the possibility of slag adhesion when coal is being burned. No burner refractories are required.

Coal Burning

Two or three burner nozzles per burner are provided when coal or other solid fuels are to be burned. In this way the coal streams are more evenly distributed across the furnace to assure good mixing of fuel and air in the furnace.

Oil Firing

A retractable type oil gun is inserted thru the center slot so as to provide complete mixing of the spray with the air stream. Oil can be burned with either steam or mechanical atomizing equipment.

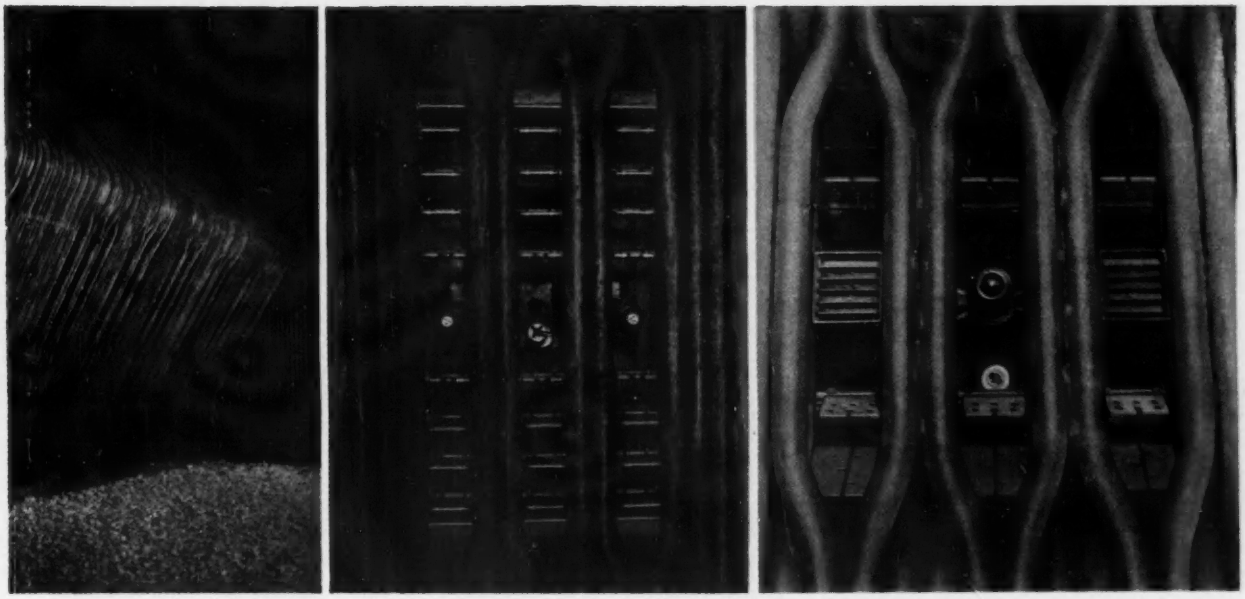
Gas Firing

Gas is fired thru guns of high alloy stainless steel. High capacity burners have a gun in each side slot. Gas guns can be installed for mechanical retraction.

A RILEY TURBO FURNACE GIVES YOU THESE MONEY-SAVING ADVANTAGES

- **The ability to fire multiple fuels: gas, oil and a wide range of solid fuels**
- **A low cost and quick conversion to solid fuels with initial gas/oil firing**
- **Higher heat release with lower overall structure**
- **Minimum Superheater/Reheater metal temperature variations across full width of furnace.**
- **No restrictions on furnace widths.**
- **One level burner operation.**

Oil or Coal?
in a RILEY TURBO FURNACE



gas guns, gas electric ignitor, observation port. Burner can easily be converted to oil and coal firing. At far right is a Directional Flame Turbo Furnace Burner for firing coal, oil, and gas. Note the complete absence of burner refractory.

Directional Vanes

Each slot is provided with directional vanes to project secondary air into the furnace so as to secure the desired placement of flame for most effective combustion. The vanes above the burner centerline and those below each have separate controls. Vanes are made of high heat resisting alloy.

Burner Shut-Off

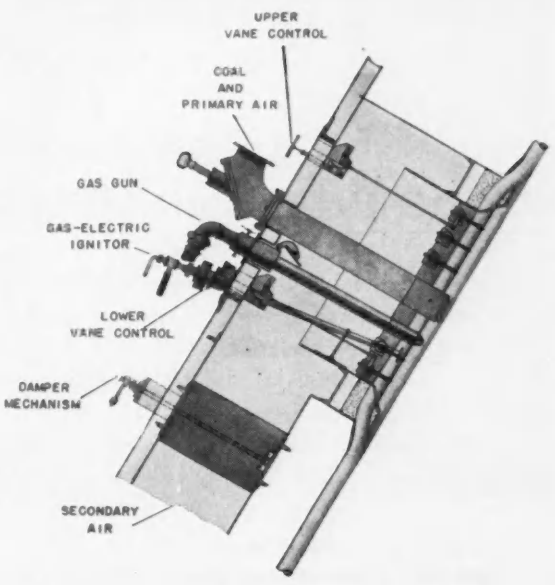
Each burner has a separate secondary air shut-off damper which can be locally or remotely controlled.

Riley Gas-Electric Ignitors

Riley Gas-Electric Ignitors are available with Riley Directional Flame Burners.

Pressurized and Non-Pressurized Operation

Riley Directional Flame Burners are designed so that they can be used either with pressurized or non-pressurized furnaces.



For the complete description of the Riley TURBO FURNACE write:

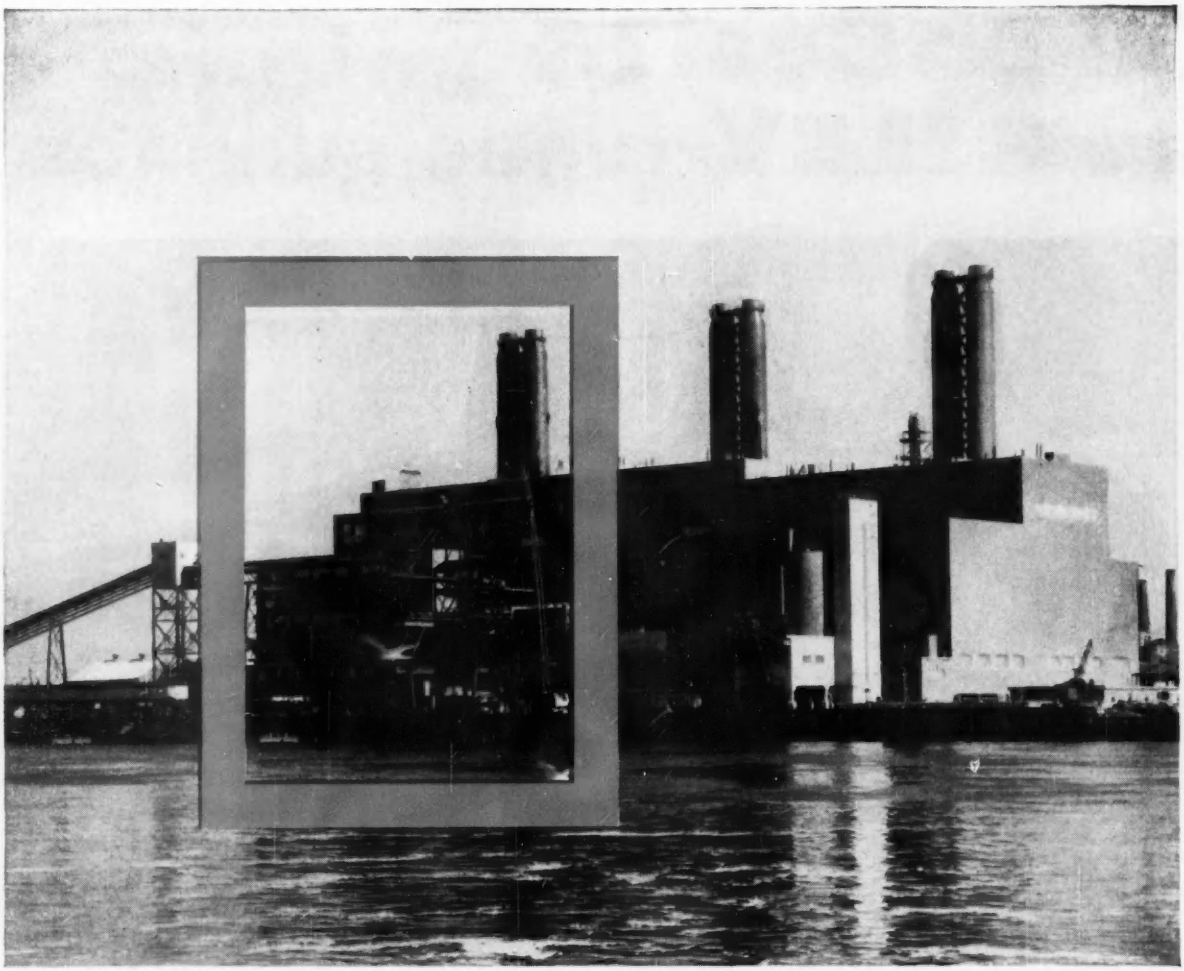
RILEY STOKER CORPORATION, Worcester, Mass.

SALES OFFICES

Boston, Charlotte, Chicago, Cincinnati, Cleveland, Denver, Detroit, Houston, Jacksonville, Kansas City, Los Angeles, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Salt Lake City, San Francisco, St. Louis, St. Paul, Seattle, Syracuse.

RILEY

STEAM GENERATING & FUEL BURNING EQUIPMENT



At Consolidated Edison's Astoria Station Unit No. 4 . . .

NEW PHELPS DODGE TECHNIQUE

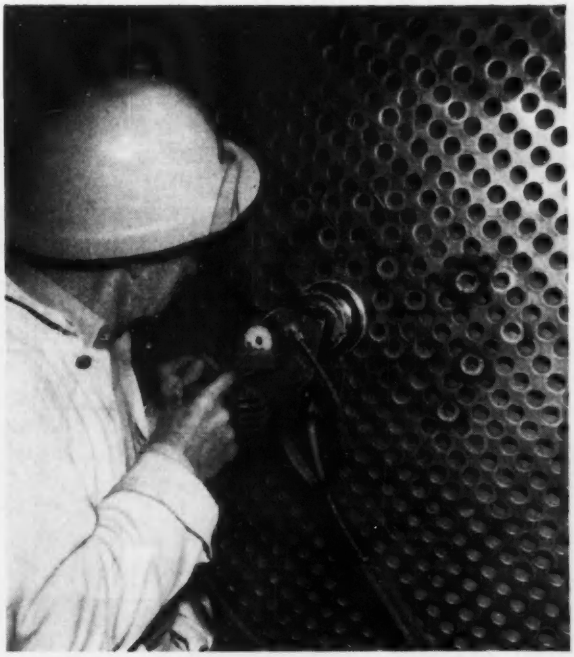
WELDS-IN ALUMINUM BRASS CONDENSER TUBES!

The first welded main condenser using aluminum-brass condenser tubes has recently been completed at Consolidated Edison's Astoria Station. This condenser will help to add a 357,000 KW block of generating capacity to the line in 1960. Half of these tubes were manufactured by Phelps Dodge under rigid specification. All of the tubes were welded in by the M. H. Treadwell Company under Phelps Dodge supervision. In tests to date, the welded condenser tube joints have surpassed performance predicted for them.

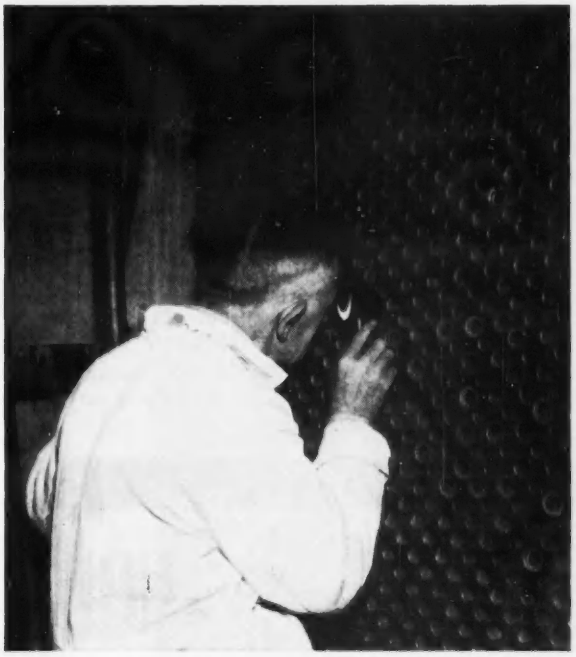
Specially designed Phelps Dodge welding guns which automatically weld tubes to tube sheets were used by Treadwell. The entire operating cycle for these guns is controlled by preset relays and timers. These relays and timers start, stop and regulate electrode motion, welding current and argon flow.

This new technique, pioneered in Phelps Dodge laboratories, answers an industry need for more positive, permanent protection from tube joint leakage. It is another in the long list of significant contributions Phelps Dodge has made in the heat exchanger and condenser tube field during more than 40 years of outstanding service.

In first step, tubes are installed in the main condenser and flared prior to welding operation. Careful attention is paid to keeping tube joints clean at all times.



Tubes are welded securely to tube sheet with special type gun. Average operator makes a completely tight weld in less than thirty seconds for each tube.



Individual tube welds are carefully inspected with magnifying glass. Incomplete or unsound welds are corrected by re-welding.

Additional inspection test consists of painting soap bubble solution on tube sheet. When main condenser is placed under 5 psi air pressure, leaks are readily detected.

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 Park Avenue, New York 22, N. Y.

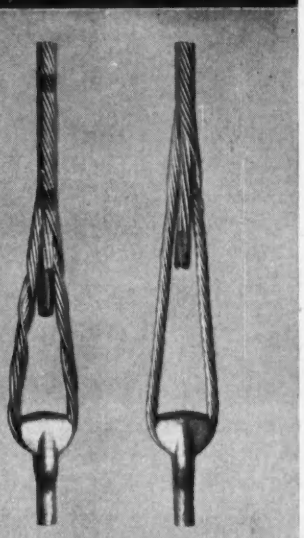
PD

Best buy for dead-ending a guy...

FANNER *Superformed** FANNGRIPS

COMPARE THE DIFFERENCES BEFORE YOU BUY HOLDING DEVICES

	Fanngrips	Automatic Jaw Types	Bolted Clamps and Clips	Manually Moused or Served
EXPERT INSTALLATIONS EASY with little skill, no tools or dies	YES	YES	NO	NO
NO-SLIP GRIP even for highest loads	YES	?	NO	NO
STREAMLINED FLEXIBILITY without excessive weight	YES	NO	NO	YES
DURABILITY at lowest cost	YES	NO	?	?
SIMPLICITY with highest strength, efficiency on EHS strands	YES	?	NO	NO
HIGH VIBRATION-FATIGUE RESISTANCE	YES	NO	NO	YES
RE-USABLE with lasting efficiency	YES	?	YES	NO



FANNGRIPS are available with open-loop design (left) for flexibility and resilience upon impact, or closed twisted-loop in many sizes for compactness where space is scarce.

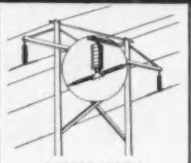
Fanngrips . . . time-proved, top-quality research/development products of Fanner, world's FIRST MAKER of machine-formed armor rods . . . provide the best available means for guying pole structures.

In addition to the cost-saving advantages shown above, Fanngrips are the only non-slip dead-ending device without biting, strand-weakening jaws.

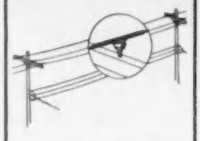
They provide maximum installation-safety, too. Wires are chamfered at ends, surfaces smooth. No burrs or jagged points to cut hands or snag gloves.

Available from stock for all sizes of galvanized steel, aluminum or copper-covered steel strands. They can also be supplied in other metals to match the strands they hold. Ask your Fanner representative for details, and for Bulletin FG-1 containing graphs for estimating savings in costs of guying materials.

A FEW FANNER *Superforms* AND FINEST PLASTIC PRODUCTS



ARMOR RODS . . . Protect long spans at supports



LINEGUARDS . . . Protect short spans at supports

FANNGRIPS . . . For dead-ending strands or conductors

FANNSPLICES . . . For joining or patching strands

Plastic **TREEGUARDS** . . . Protect conductor surface covering

Plastic **KOVER-GUARDS** . . . Protect surface-mounted conductors

*A superior forming method in accordance with Patents No. 2,769,478 and 2,588,663—other patents applied for.

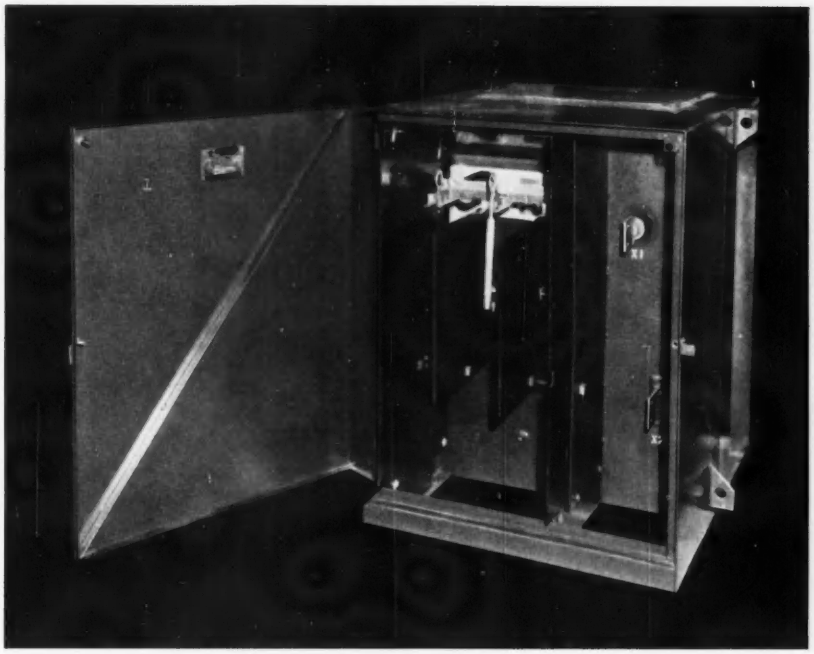
THE FANNER MANUFACTURING COMPANY
Brookside Park • Cleveland 9, Ohio

DIVISION OF TEXTRON, INC.

Fine Fanner Superformed Products

A-6025A

Switch and Protect Residential Underground Circuits... In Air... The Straightforward Overhead Way



. . . with S&C's new pad mounted gear —fuses and disconnects expressly designed for compact, air-filled enclosures.

GIVE IT AIR

FOR TRANSFORMERS

Now, IN AIR, you can protect, switch, and isolate pad mounted transformers and buried cable. S&C's pad mounted gear, matched to side-bushing pad mounted transformers, gives you the simplicity and practicality of *overhead* distribution practices on residential *underground* circuits. Here are the highlights:

1 Full load switching . . . plus all fault interruption . . . is outside the transformer, in air. No arcs are drawn under oil while switching or during fault interruption or inadvertent closing on a fault. This means: no fires or explosions, no oil "burping" out of openings, and no contamination of oil.

2 The side bushing on the transformer primary is housed within this adjoining enclosure and becomes the support for the fuse hinge. Transformer can be changed out easily without disturbing incoming cables.

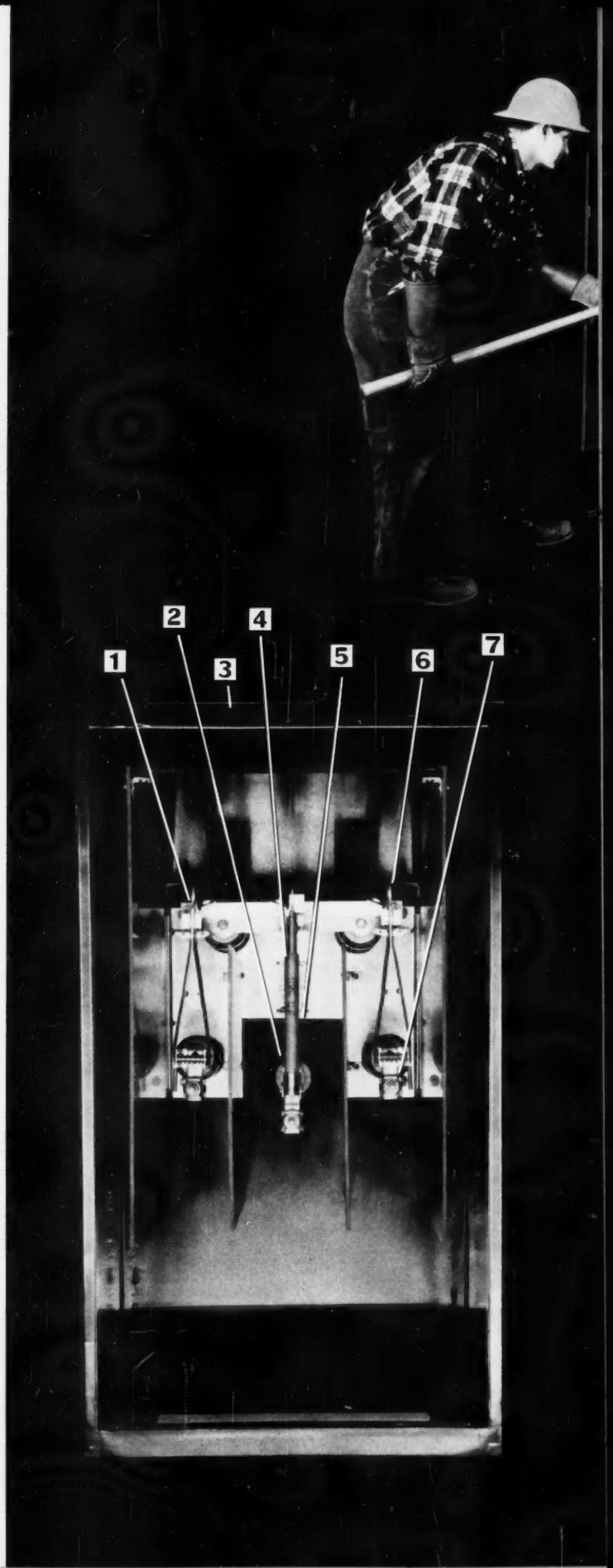
3 To anticipate load growth, primary gear can be installed *without* transformer. Transformer can be added at a future date, without disrupting service.

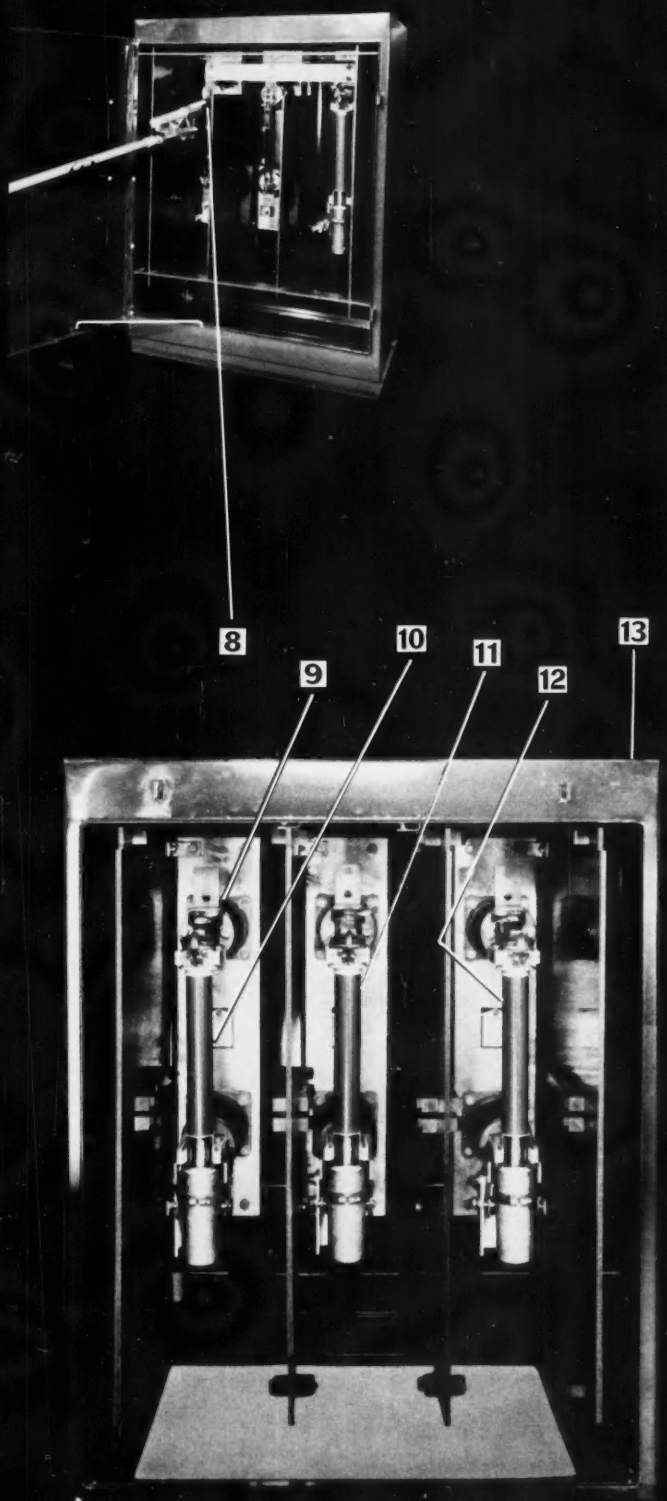
4 Fuse eliminates need for primary link inside transformer—means no untanking of the transformer to re-fuse.

5 Primary fuse sees secondary faults, eliminates secondary breaker.

6 Both transformers and cables can be switched. This performance applies to load currents, charging currents, or magnetizing currents.

7 The transformer or the cable can be fully isolated without disturbing the incoming cable connections.





FOR SECTIONALIZING

Now, with S&C pad mounted gear you can also get the advantages of overhead-type sectionalizing. Teamed with the transformer primary gear shown on the opposite page, this sectionalizing gear puts your residential distribution system *completely* underground—eliminates the hybrid combination of overhead sectionalizing with pad mounted transformers. Here are some additional features:

8 With Loadbuster, S&C's portable loadbreak tool, you can switch and interrupt full loads . . . up to 400 amperes of load current at 14.4 kv. This combination of S&C pad mounted gear and Loadbuster gives positive, arc-free interruption of all associated magnetizing and line charging currents. (Loadbuster works equally well with disconnects, as shown, or with fuses.)

9 External switching also means visible air gaps and readily accessible, visible circuitry. Operators *know* what they are doing because they can *see* what they are doing.

10 Fuses are available in ratings up to 200E amperes continuous, with interrupting ratings of 17,500 amperes asymmetrical. They are readily accessible, easy to change.

11 Wide choice of fuse ratings permits close coordination, plus ability to uprate system to accommodate future growth needs.

12 Boric acid fuse is used (not an expulsion cutout) . . . gives low energy discharge when clearing faults. And exhaust gases are less conducting and are condensable, thus reducing pressure in the enclosure.

13 S&C sectionalizing units are available in standard and heavy duty styles. Numerous combinations of fuses and disconnects are available to fit almost any scheme of circuitry.

S&C ELECTRIC COMPANY

4435 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High-Voltage Circuit Interruption since 1911

S&C

You can order S&C pad mounted gear in almost any disconnect and fuse arrangement for sectionalizing

The following tables describe the many variations possible in S&C complete units for pad mounted sectionalizing applications. These free standing, self-supporting enclosures are equipped for cable entrance and exit through the bottom. All disconnects and fuses are equipped with attachment hooks to accommodate Load-buster.

COMPLETE UNITS—HEAVY DUTY STYLE (Less Fuse Holders and Refill Units)

Item	Illustration	Fuse Type and Max Ampere Rating	Rating					Catalog Number
			Kv		Amperes			
			Nominal	Max Des.	Disconnect Cont.	Disconnect Momentary	Fuse Inter. RMS Asym.	
Pad Mounted Fused Switching Unit—Heavy Duty Style—Three Pole Single Phase		SM-4D 200E	14.4	15*	600	25000	14000‡	4900
Pad Mounted Fused Switching Unit—Heavy Duty Style—Two Pole Single Phase		SM-4D 200E	14.4	15*	600	25000	14000‡	4901
Pad Mounted Fuse Unit—Heavy Duty Style —Three Pole Three Phase		SM-4D 200E	14.4	15*	....	....	14000‡	4926
Pad Mounted Switching Unit—Heavy Duty Style —Three Pole Three Phase		....	14.4	15*	600	25000	....	4925

* 95 kv BIL ‡15000 amperes at 7.2 kv, 4.8/8.32 kv Gr Y, 12 kv, and 7.2/12.47 kv Gr Y; 17500 amperes at 2.4 kv, 2.4/4.16 kv Gr Y, and 4.8 kv.

COMPLETE UNITS—STANDARD DUTY STYLE (Less Fuse Units)

Item	Illustration	Fuse Type and Max Ampere Rating	Rating					Catalog Number
			Kv		Amperes			
			Nominal	Max Des.	Disconnect Cont.	Disconnect Momentary	Fuse Inter. RMS Asym.	
Pad Mounted Fused Switching Unit—Standard Duty Style—Three Pole Single Phase		PM† 50	7.62/13.2 Gr Y	8.25*	200	8000	8000	4874
			14.4	15*	200	8000	8000	4870
Pad Mounted Fused Switching Unit—Standard Duty Style—Two Pole Single Phase		PM† 50	7.62/13.2 Gr Y	8.25*	200	8000	8000	4877
Pad Mounted Switching Unit—Standard Duty Style—Three Pole Single Phase		....	14.4	15*	200	8000	....	4879
Pad Mounted Switching Unit—Standard Duty Style—Three Pole Phase		....	14.4	15*	200	8000	....	4880

*95 kv BIL †Available in EEI-NEMA "K" Speed Ratings

...or components for transformer primary applications

The following table lists the S&C fuses, disconnects, and fused disconnects for switching and protecting pad mounted transformers. Enclosures are provided by the transformer manufacturer as an integral part of the transformer housing, although separate from the transformer itself.

COMPONENTS—STANDARD DUTY STYLE (Less Fuse Units)

Item	Illustration	Fuse Type and Max Ampere Rating	Rating					Catalog Number
			Kv		Amperes			
			Nominal	Max Des.	Disconnect Cont.	Disconnect Momentary	Fuse Inter. RMS Asym.	
Pad Mounted Disconnect—Standard Duty Style —Single Pole		....	14.4	15*	200	8000	....	4800
Pad Mounted Fuse Mounting—Standard Duty Style—Single Pole		PM† 50	7.62/13.2Gr Y	8.25*	....	....	8000	4801
			14.4	15*	....	....	8000	4802
Pad Mounted Fused Disconnect—Standard Duty Style—Three Pole Single Phase Four Insulator		PM† 50	7.62/13.2 Gr Y	8.25*	200	8000	8000	4803
Pad Mounted Fused Disconnect—Standard Duty Style—Three Pole Single Phase Five Insulator		PM† 50	7.62/13.2 Gr Y	8.25*	200	8000	8000	4804
			14.4	15*	200	8000	8000	4810
Pad Mounted Fused Disconnect—Standard Duty Style—Two Pole Single Phase Two Insulator		PM† 50	7.62/13.2 Gr Y	8.25*	200	8000	8000	4806
Pad Mounted Fused Disconnect—Standard Duty Style—Two Pole Single Phase Three Insulator		PM† 50	7.62/13.2 Gr Y	8.25*	200	8000	8000	4807
Pad Mounted Disconnect—Standard Duty Style—Three Pole Single Phase		....	14.4	15*	200	8000	....	4809

*95 kv BIL †Available in EEI-NEMA "K" speed ratings

For additional information on S&C pad mounted gear, contact your local S&C representative or write to:

S&C ELECTRIC COMPANY 4435 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1911

Gulf States Utilities bought the versatile ISI 609 Information and Computer System

609

Now passing the 6,000 hour mark for continuous operation with only minor maintenance, this ISI 609 computes station heat rate, by input-output method, of Units 1, 2 and 3 at Roy S. Nelson Station. Calculations are based on direct computer measurements of temperatures, pressures, and flows. Over 200 variables are continuously scanned for alarm detection and hourly logging on automatic typewriters.

Practical information for profitable control

With over 130 data systems now operating in utilities and process plants, Information Systems, Inc. offers eleven years of experience in all phases of industrial data gathering, information display and computer information systems. An exceptionally broad, completely integrated service is backed by proven hardware designed for reliable, economical control systems. ISI Information Systems guarantee practical information and exceptional versatility.

YOUR COMPANY undoubtedly will install a control system. Will it supply useful, meaningful information immediately? Will it improve plant efficiency and product quality with economic feasibility? Will it furnish closed loop, fully automated control with economy whenever you take the final step? *Your executives should evaluate ISI before you buy. Please write for capability and case history data, or contact your nearest ISI office.*

YOUR BEST INVESTMENT IN POWER AND PROCESS CONTROL • INFORMATION HANDLING • INDUSTRIAL AUTOMATION • NATURAL GAS DISPATCHING

ISI

INFORMATION SYSTEMS, INC.

SYSTEMS DIVISION

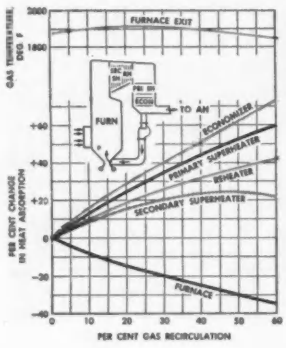
10131 NATIONAL BOULEVARD, LOS ANGELES 34, CALIFORNIA

Regional Offices in New York City • Chicago • Houston • Los Angeles

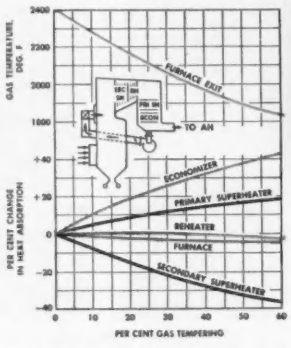
Now—precise heat and temperature control
—where you need it and when you need it

EFFECT OF GAS CONDITIONING

Effect of Gas Recirculation in Hopper
(Constant Firing Rate)



Effect of Gas Tempering at Furnace Exit
(Constant Firing Rate)



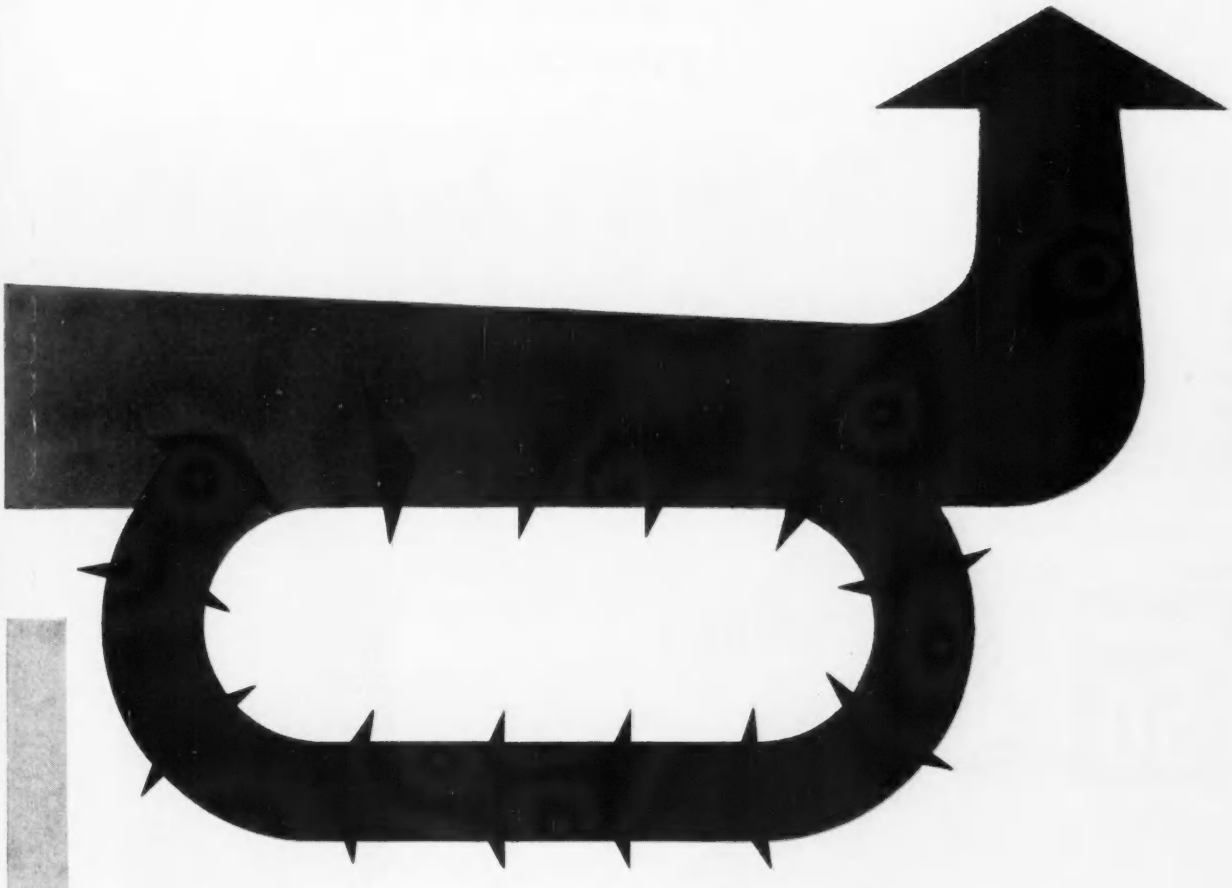
B&W GAS

B&W engineering concept tempers furnace exit gases and controls absorption patterns for improved design, operating and maintenance characteristics

Just as the heating and cooling systems in your home condition air to provide a moderate, healthful atmosphere under the "load" of varying climate . . . B&W Gas Conditioning provides moderated, balanced gas temperature in the boiler under varying conditions of load, changes in fuel characteristics, and varying cleanliness of heat absorption surfaces.

Gas Conditioning is the composite use of "cool" flue gases recirculated either to reduce gas temperature at the furnace exit (gas tempering) or to control heat absorption relationships between the furnace and the superheater-reheater surfaces (gas recirculation).

Increasing load normally brings up gas temperature,



CONDITIONING

however, Gas Conditioning introduces proportioned flue gas to "temper" furnace exit gas to maintain desired temperature. This greatly reduces ash fouling, corrosion and creep of tube surfaces in the superheater, guards against enameling of ash on superheater tubes, and permits a significant reduction in the high alloy requirements.

As load decreases, Gas Conditioning recirculates proportioned flue gas through the furnace, controlling furnace heat absorption and thereby maintaining constant steam temperatures for efficient performance.

B&W GAS CONDITIONING has been soundly proved in operation, and deserves serious consideration in any discussion of new boiler design. Additional information and case history data are available on request. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

G-968

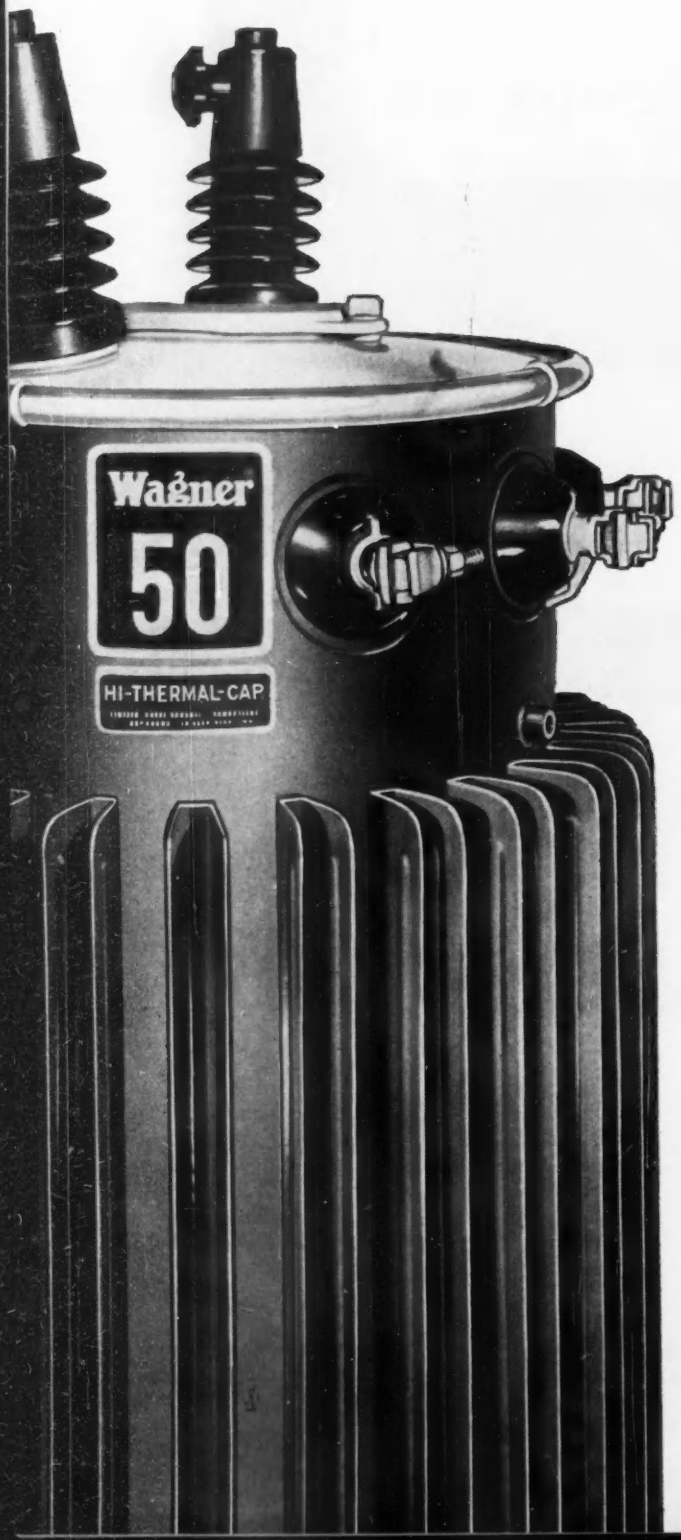
B&W

THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

Get $1.12 worth of usable Kva for every $1.00 you invest in

WAGNER®



More for Your Money in Mechanical Features:

PLASTIC-COATED COVER

A porcelain-like coating gives improved corrosion resistance to tank covers, protects from line to ground, insulates small animals from the grounded cover to prevent outages. Applied to the covers, clamping ring and cover bolts, it is available without extra cost on all transformers with cover mounted bushings.

LONG LASTING TANK FINISH

A new formula anti-corrosive paint, carefully applied and thoroughly cured, provides a "Sure Seal" finish that withstands all temperature changes—is much longer lasting in corrosive atmospheres.

SAFETY KEYED BUSHINGS

Heavy wet-process porcelain high voltage bushings are safety-keyed. All terminals are key-locked in the tank wall. Hand tightening terminals are easily hooked up without tools. All bushings are suitable for use with either aluminum or copper conductor.

ROLLED-UNDER BASES

This new base design provides extra strength . . . better moisture drainage. Serves as an additional safeguard against leakage of oil from the tank. It lessens the chance for finish damage due to scraping.

HI-THERMAL-CAP

WAGNER® HIGH CAPABILITY TRANSFORMER
112% NAMEPLATE KVA 65°C. HOT SPOT RISE

TRANSFORMERS

Prize investment, these Wagner® Hi-Thermal-Cap Transformers. Wise buys in High Capability Distribution Transformers that pay off in one dollar and twelve cents worth of usable kva for every dollar of their cost. Solid performers that you can safely uprate to 112% of their nameplate kva without shortening their normal life expectancy, *and without exceeding the allowable 65°C hot spot temperature rise.*

We've built new, compact coils for these money-savers. They're wound LV-HV-LV around one insulating cylinder, and locked into sections of great mechanical strength by corrugated oil ducts and thermosetting insulation. Short circuit tests using 50 times normal current (twice as much as the industry standard) didn't even faze them.

The HI-THERMAL-CAP element, which combines this improved coil with a wound core of cold-rolled oriented grain steel, has excellent electrical characteristics: low impedance for better voltage regulation; low core and copper loss for economical operation. The result: you get top efficiency *plus* high capability with these transformers.

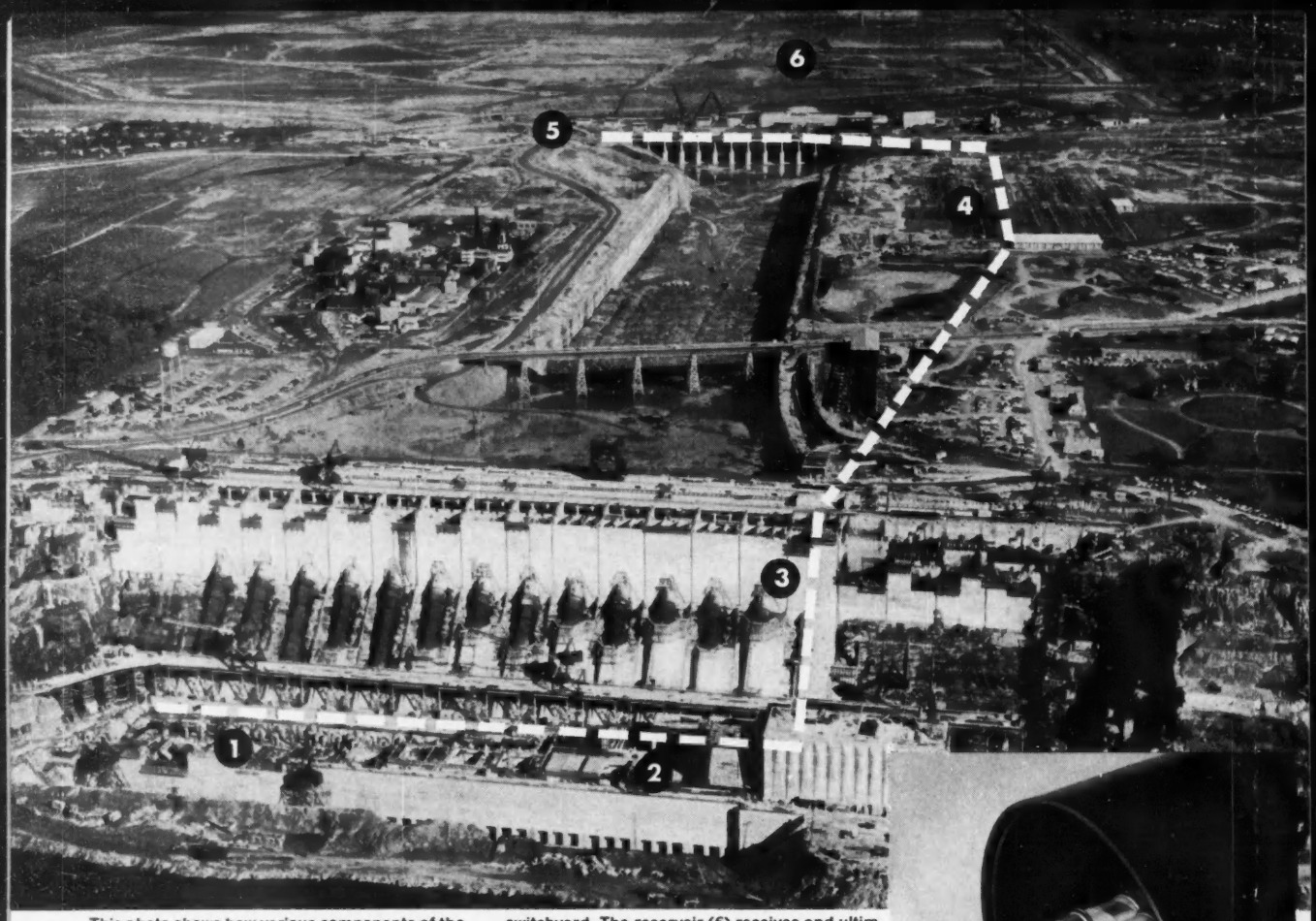
BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

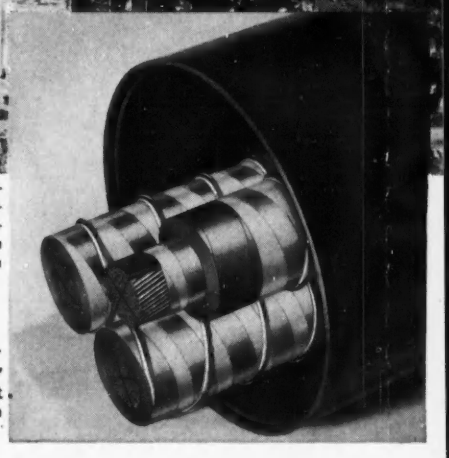
6456 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

HI-THERMAL-CAP TRANSFORMERS
are available in singlephase ratings of 167 kva and smaller, 15 KV and below for direct pole mounting. You can get them from factory, branch or distributor stocks now. And you can get complete information from your Wagner Sales Engineer. Check with him, or write us.

WT61-2



This photo shows how various components of the Niagara Power Project are electrically interconnected by nineteen 115kv and 230kv Oilostatic circuits enclosed in 8⅝" O.D. pipe and installed in underground tunnels. From the Robert Moses Niagara Power Plant in the foreground (height 340 feet above the level of the Niagara River), six 230kv (1) and seven 115kv Oilostatic circuits (2) transmit power from generators up a 45°-incline power tunnel (3) to the switchyard (4). Two other 115kv circuits tie the 115kv bus to the 230kv bus through auto-transformers. The remaining four 230kv circuits connect the motor-generator units at the reservoir plant (5) to the switchyard. The reservoir (6) receives and ultimately discharges water through the motor-generator units. Not shown are two water conduits which carry water from the intake structure above Niagara Falls to the open canal between the power plants.



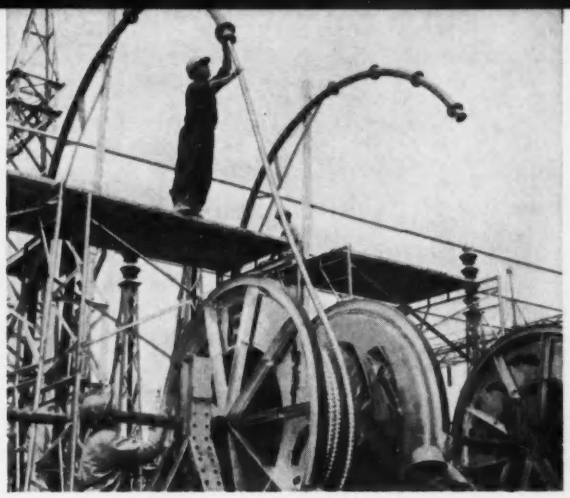
Cross-section of 115kv Oilostatic circuit in 8⅝" O.D. steel pipe. This 3-phase 1750 MCM circuit carries the entire output of one 167,000kva generator.

Niagara Power Project chooses **Okonite Oilostatic® Cable** to carry a giant power load

At one of the world's largest power projects—the New York State Power Authority's 2,470,000-kva Niagara Power Project—60,000 feet of Okonite Oilostatic cable are helping to solve some giant power transmission problems.

A total of nineteen 115kv and 230kv Oilostatic circuits tie together the various components of this $720,000,000 complex. These include: the Robert Moses Niagara Power Plant . . . the Reservoir Pump Generating Plant which alternately fills and receives water from a storage reservoir . . . two conduits to carry water from an intake structure above Niagara Falls . . . and a 115kv-230kv-345kv switchyard.

Why was Okonite Oilostatic Cable chosen to carry power from this giant project? One reason was the New York State Power Authority's desire to combine sound engineering practice with an architecturally appropriate appearance. Careful preliminary



Installing 115kv Oilostatic cables for auto-transformer circuits, workmen use large radius tube for feeding cable into riser pipes.

studies indicated Oilostatic was well suited to solve the project's problems involving congestion (which made overhead constructions impractical), appearance, maintenance and reliability.

This project presented several unique design and installation techniques which were studied and solved by the consulting firm of Uhl, Hall and Rich, working with the Okonite Engineering staff. All Oilostatic circuits in 8⅝" O.D. steel pipe were mounted in underground tunnels, installed prestressed to a length equivalent to a temperature of 70°F. The thirteen circuits at the Robert Moses Niagara Power Plant drop a vertical distance of 250 feet on a 45° angle. Standard Oilostatic cable construction was used for this unusual situation.

Four 230kv circuits from the Reservoir Pump Generating Plant to the switchyard cross an open water canal on a specially designed bridge. The Oilostatic systems are supported on roller type hangers allowing the bridge and cable circuits to expand independently. For the first time in the United States condenser type potheads were used to terminate the 230kv circuits. Except for these potheads, other material used on the project—including cable, pipe, oil, cable joints and pumping plants—are standard Okonite equipment.

This is the kind of problem-solving performance for which Okonite has long been noted. It's just one more example of Okonite Cable'bility* in action. At the free world's largest power project, as in other vital projects, large and small, Okonite cables have long been recognized as the *best for the job.*

*OKONITE Cable'bility...cable craftsmanship since 1878

Base plate bolts are tightened as final assembly of a pothead stress cone is made, prior to positioning of six-foot porcelain bushing. A total of 114 high-voltage potheads were used on this project.

One of the four pressure control units that automatically maintain oil pressure at 200 psi throughout the system.

THE OKONITE COMPANY
Subsidiary of Kennecott Copper Corporation
Passaic, New Jersey

where there's electrical power... there's **OKONITE CABLE**

8175

Use for Billing or Survey—Visually Interpret or Automatically Process the Punched Tape Record

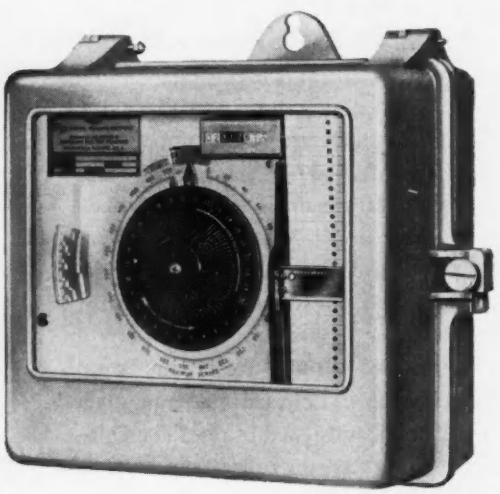
A versatile demand instrument—the Sangamo DDR. This impulse operated block interval demand recorder is ideal for both billing and survey applications. The permanent punched tape record can be interpreted visually with ease and accuracy or it can be processed automatically. Consider these additional values . . . pulse saver, kw-kvar-kva functions, tape record visible for several hours so you can see peaks and outages right after they occur.

The DDR is available to you *now* for billing and survey . . . *whether or not your company has automatic data processing.* Where automatic data processing is not presently used, the DDR provides a permanent record that can be accurately interpreted visually. When processing is automated, the DDR then becomes an integral part of the system.

If your billing or survey data processing is now automated, the DDR method means fast translation. Sangamo's translator permits direct, accurate and economical conversion of tape data. It can be used with your present key-punch equipment to produce punched cards, or fast translation service is available from Sangamo at a nominal cost.

SANGAMO DDR

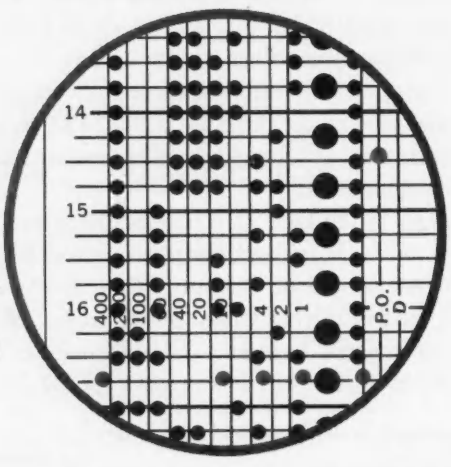
DIGITAL DEMAND RECORDERS



PICK THE PEAK AND READ IT!

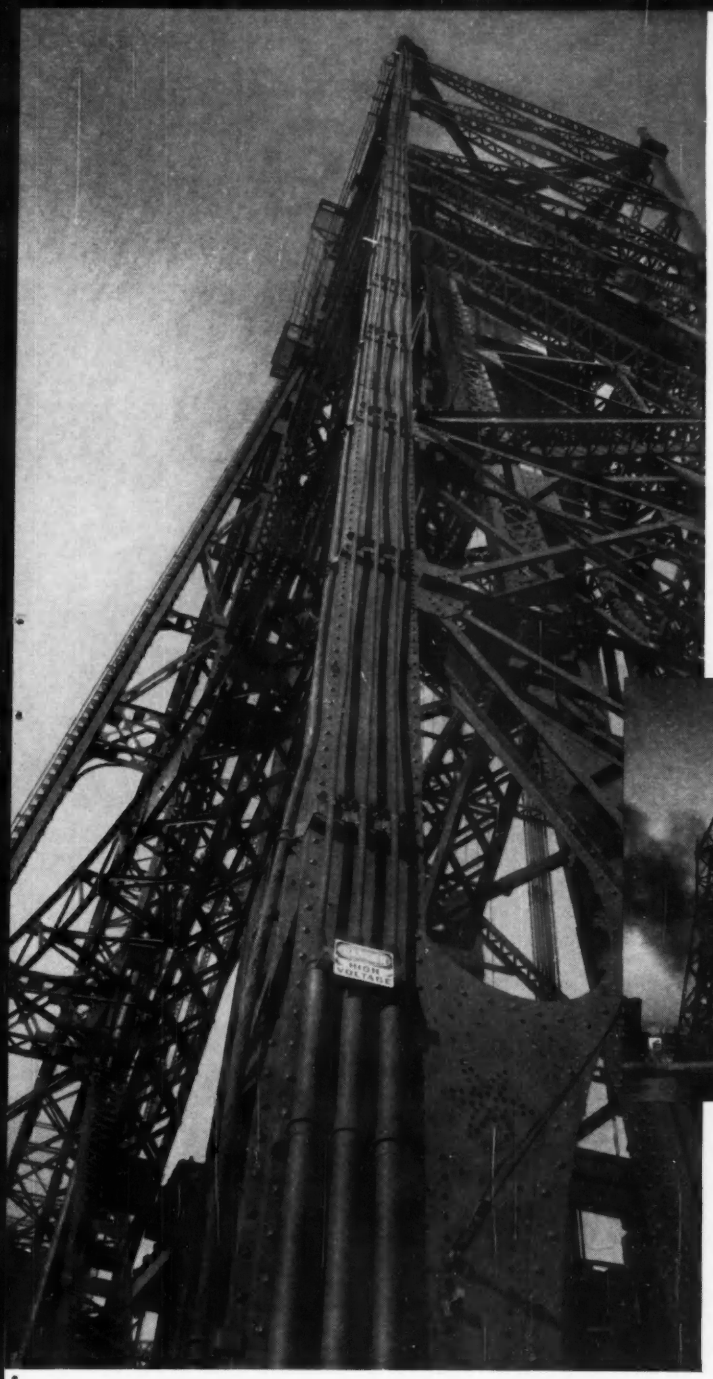
The enlarged section of tape at right shows how simple it is . . . See the punch farthest to the left at 16¾ hours? Read it: 400 plus 10 plus 4 plus 1 equals 415. A quick glance at the right-hand side of the tape shows a power outage at 14½ hours. The processed tape provides a permanent *exact* record that eliminates arbitrary interpretations of charts.

The DDR is available for 5, 15, 30 and 60 minute intervals—easily converts from one interval to another. A single roll of tape (15 minute interval) permits three months of continuous recording *yet allows monthly* record removal. Get the complete story from your Sangamo representative or write for Bulletin 360.



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



Vibration... Intense Cold...

POLYETHYLENE-INSULATED CABLES DEFY RIGOROUS BRIDGE CONDITIONS!

Early in 1955, at temperatures well below zero, three 14-kv power cables insulated with BAKELITE polyethylene and jacketed with Densheath PVC were installed on this aerial lift bridge at Duluth, Minn. Five winters later, the cables are still giving dependable service, despite the hazardous conditions of bridge vibration and extreme cold. Cables were manufactured by the Anaconda Wire and Cable Company for the Minnesota Light and Power Company.

Bridge installations provide one of the most rigorous physical tests for power cables. Only the toughest insulation can withstand for extended periods the damaging effects of bridge vibration . . . especially at low temperatures!

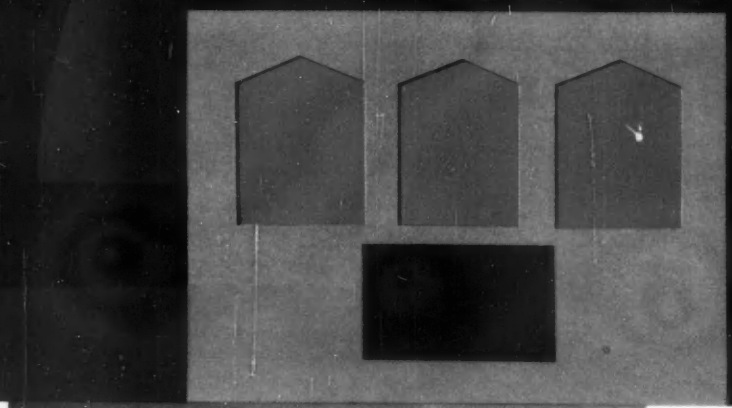
Three high-voltage cables insulated with BAKELITE polyethylene have passed such a test and, after five years, are still giving unfailing service. The polyethylene insulation has resisted not only the expected mechanical abuse, but the frigid Minnesota winters as well. Average winter temperatures in this area are 10 to 15 deg. F. and temperatures may reach as low as –41 deg. F.

Insulation of BAKELITE polyethylene has proved to be tough, durable, highly resistant to moisture and cracking, and an excellent low-loss dielectric . . . even at low temperatures. Union Carbide Plastics Company has pioneered the development of polyethylene and vinyl insulating and jacketing materials for optimum performance under severe conditions. For specific information on BAKELITE polyethylene and vinyl compounds, please write to Dept. KV43B, Union Carbide Plastics Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, New York. *In Canada:* Union Carbide Canada Limited, Toronto 12.

UNION CARBIDE

BAKELITE and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

Why Electro-Motive peaking



You can put

When you put the peaking power at the point of load (which can best be done with Electro-Motive Peaking Plants) you gain these five important system improvements.

REDUCED ANNUAL COSTS—You defer investment for new transmission equipment. You generate peaking power without transmission loss.

AUTOMATIC PEAKING POWER—You get automatic, unattended peaking

power makes sense

the peaking power at the point of load

power . . . practically eliminate preparation-for-peak expenses.

AREA PROTECTION—You gain automatic, unattended area protection in case of line outage.

INDEPENDENT MAINTENANCE—Your peaking and area protection generation is not affected by central station maintenance.

STANDARDIZED EQUIPMENT—You get standardized Electro-Motive equipment, completely self-housed, portable and conveniently sized to fit any location.

The logic of decentralized Electro-Motive Peaking Plants can be the answer, if you are looking for the next step in system efficiency. Electro-Motive power can mean substantial savings in many areas of your system operation. For a complete description of all the advantages of decentralized Electro-Motive Peaking Plants, contact your Electro-Motive representative.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS
LA GRANGE, ILLINOIS

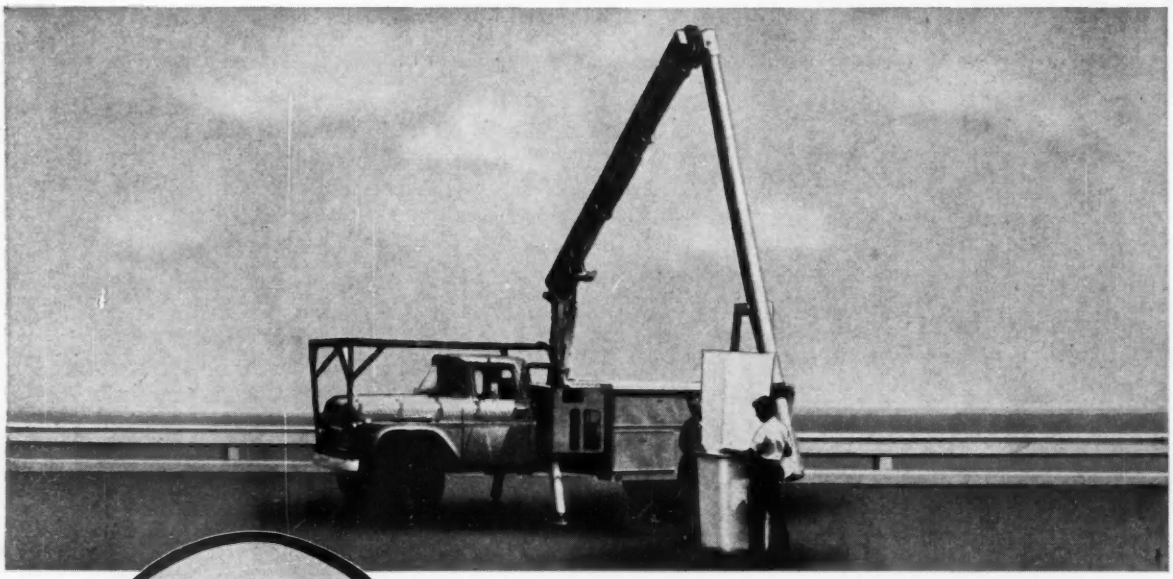
Offices: Chicago, New York, St. Louis, San Francisco • **In Canada:** General Motors Diesel Limited, London, Ontario

BASKET LINERS

Eliminate difficult basket tests

Dielectric safety is assured for the man in the aerial basket by the use of the newly developed Insert Liner. Eliminated is the costly and difficult task of a scheduled testing program on the basket itself. The liner, easily removed, makes it simple to maintain the necessary testing program for dielectric safety.

Every Asplundh Liner is tested by an independent testing laboratory and certified to 50,000 volts, or higher if desired.



Four ways you benefit

when you use an Asplundh Insert Liner

- No need to test the basket—test the liner only, keeping the lift in continuous use.
- Liners are inexpensive; keep an extra one available.
- Simple to store and easy to handle. Insert in a matter of minutes, no tools needed.
- Remove any water by simply emptying liner, thus saving time and inconvenience.

Remember, dielectric safety is yours with the "Big 3"—the **SPIRALLOY** Boom—the **SPIRALLOY** Pylon Mast Insert—and the Basket Liner—but only through Asplundh —most advanced designer and user of aerial devices.

Another important improvement by Asplundh, where "Future Developments" are Produced Today!

ASPLUNDH **Chipper Company**

501 York Rd., Jenkintown, Pa.

HAS SERIES SUSPENSION CLAMP

Cast from high-strength, non-corrosive aluminum alloy, Anderson HAS Suspension Clamps minimize heat build-up... save 90% or more of power losses prevalent in ferrous clamps. In addition, superior Anderson design gives you extra strength with lightest possible weight... eliminates destructive damping effect of vibration at the suspension point.

OUTSTANDING ANDERSON DESIGN FEATURES:

- Flared mouth prevents chafing
- Clevis pin locked against rotation
- Speed cotter key facilitates maintenance while energized

A COOL CASE

of better suspension

SD DEAD-END STRAIN CLAMP

1. **Added nose extension** . . . of Anderson Aluminum SD Dead End Strain Clamps allows span end of clamp to seat in hot line strain carriers. Result: much easier maintenance of strain insulator strings.
2. **Keeper pieces captured to U-bolts** . . . for extra fast installation. No need to cut cable for insertion . . . no disassembly required.

A SMOOTH CASE

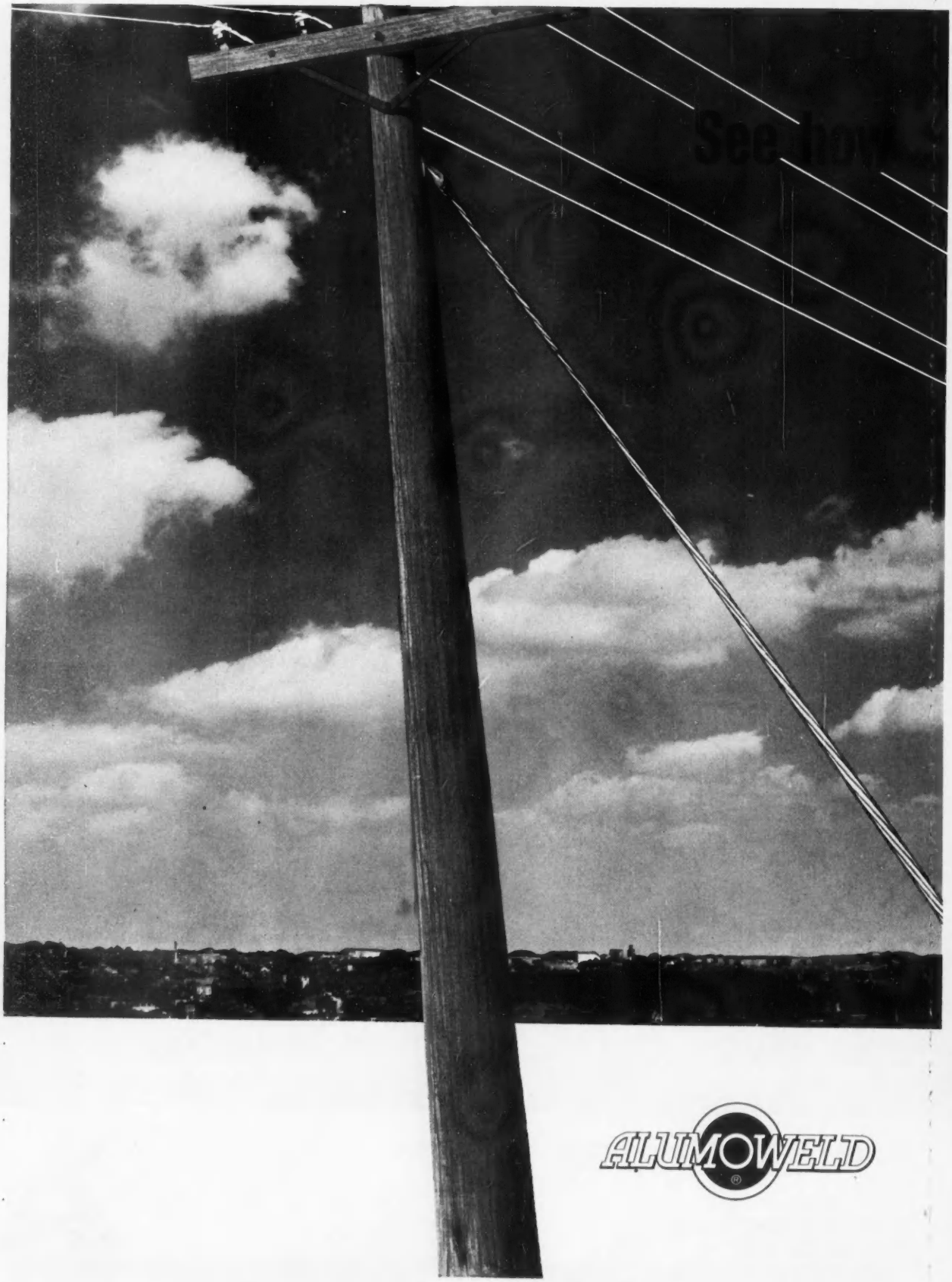
of better deadending

Anderson keeps power up, heat down

ANDERSON ELECTRIC

Research / Quality / Performance / in Aluminum and Bronze Products

ANDERSON ELECTRIC CORPORATION, P. O. DRAWER 2151, BIRMINGHAM 1, ALABAMA


See how
ALUMOWELD

ALUMOWELD
can fill your requirements for guying installations...

ALUMOWELD, made by the controlled atomic-welding process, combines aluminum and steel to give you strand with *permanent* high strength. The following facts tell you why Alumoweld should be your choice for guying installations.

STRENGTH— Alumoweld has a higher strength-to-weight ratio than any other strand used on overhead lines. Size for size, Alumoweld has the same tensile strength as extra-high-strength steel . . . weighs 18% less . . . and will last far longer.

CORROSION RESISTANCE— a *thick* cladding of pure aluminum—25% by area—gives Alumoweld the same long life and high resistance to corrosion as solid aluminum.

EASIER TO INSTALL— Because of its lighter weight, Alumoweld is easier to handle so installation is faster. Dead-end fittings and other accessories are available from suppliers.

LOW COST— Alumoweld not only gives you the money-saving benefits of low initial cost, but it eliminates maintenance costs for the life of your lines.

Supplies of Alumoweld Strand are available for prompt shipment from our warehouses in New York, Chicago, Pittsburgh and Memphis.

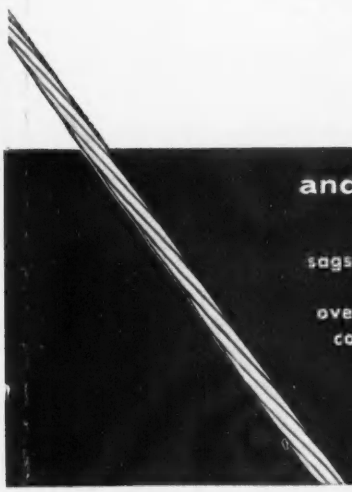
For the complete story on Alumoweld, write for Engineering Bulletin E. D. 3000.

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION Glassport, Pa.

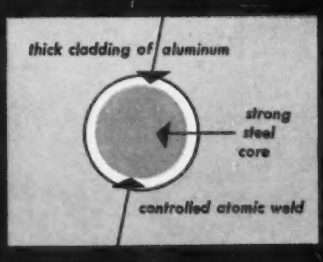
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

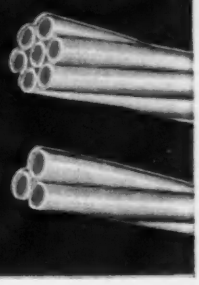
Canadian Distributor: NORTHERN ELECTRIC COMPANY LIMITED

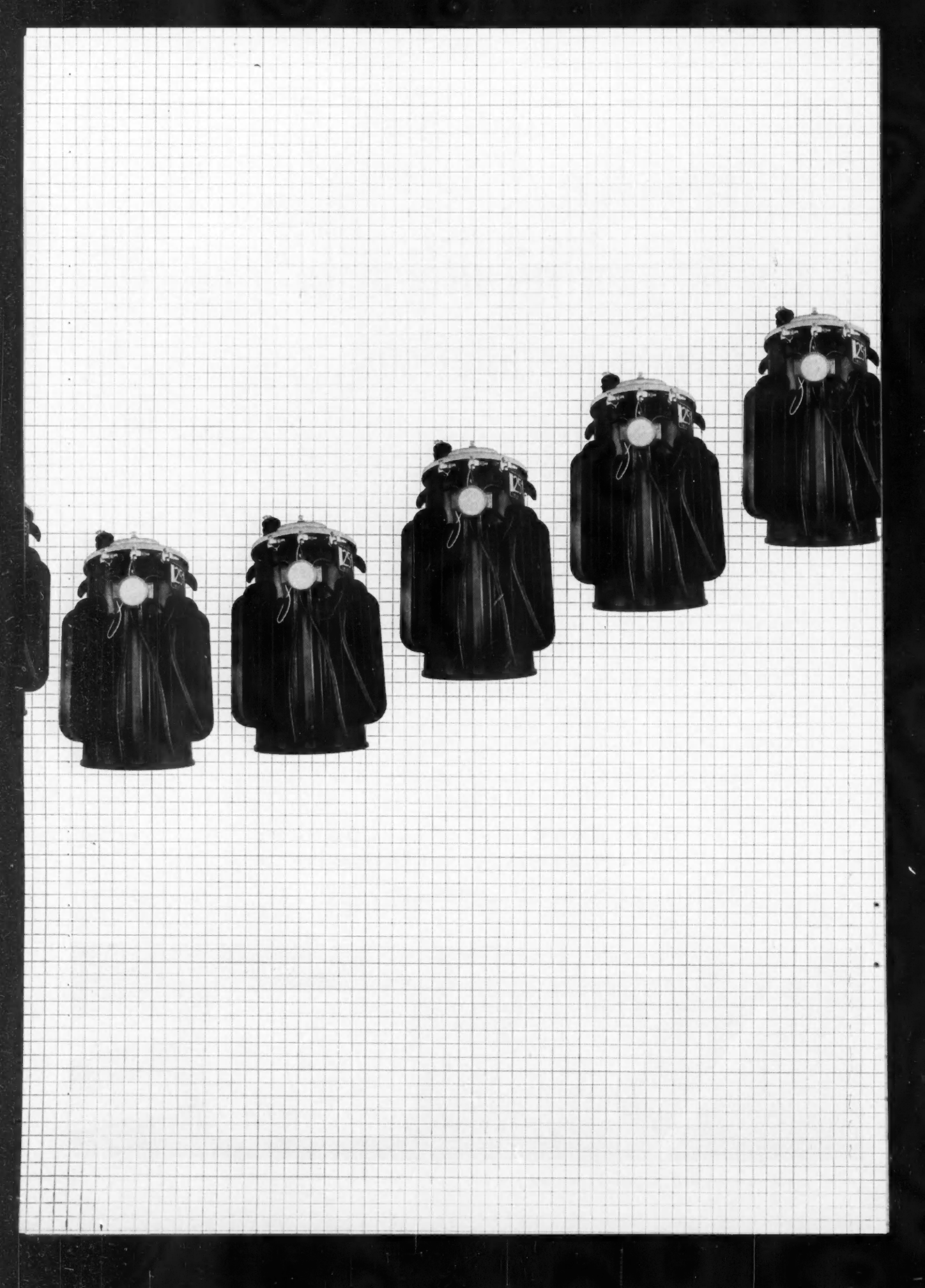


and FOR OVERHEAD GROUND WIRES

You can string with smaller sags to increase mid-span clearance when you use Alumoweld for overhead ground wire. Its excellent conductivity—3 times as much as steel—is helpful in reducing service interruptions by quickly discharging transient currents to ground.







UNECONOMICAL LOAD TURNS SIGNAL LIGHT ON

Now—Westinghouse TL load indicators for 10 through 50 kva transformers

simplify system load management . . . fit 90% of existing transformers

Why wait for a voltage complaint to tell you about excessive overload?

Hook up a new Westinghouse TL load indicator right on the outside of the transformer.

Then when there's an economically significant overload, the signal light turns red. (A brief peak overload *doesn't* turn the light on.)

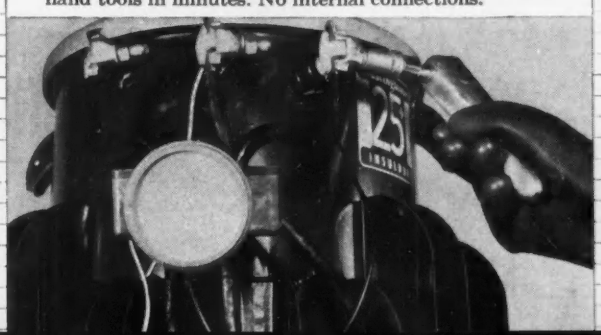
Who determines what overload is excessive? *You* do. The Westinghouse TL load indicator comes calibrated for recommended transformer loadings. But you can set the overload limit higher or lower.

Cost? $10 if you install it. When you buy a new Westinghouse transformer, a TL indicator, factory-installed, costs only $6.

Using Westinghouse TL load indicators, you change out your transformers at the most economical point. There's a model to fit every pole-type transformer, 10 through 50 kva, made since 1935. They give you the simplest, cheapest way yet devised to keep a check on your non-CSP transformers, and manage your system with practically no transformer overload problems.

Your Westinghouse sales representative has complete technical details. You can be sure . . . if it's Westinghouse. J-70952

Westinghouse TL load indicator installs with simple hand tools in minutes. No internal connections.



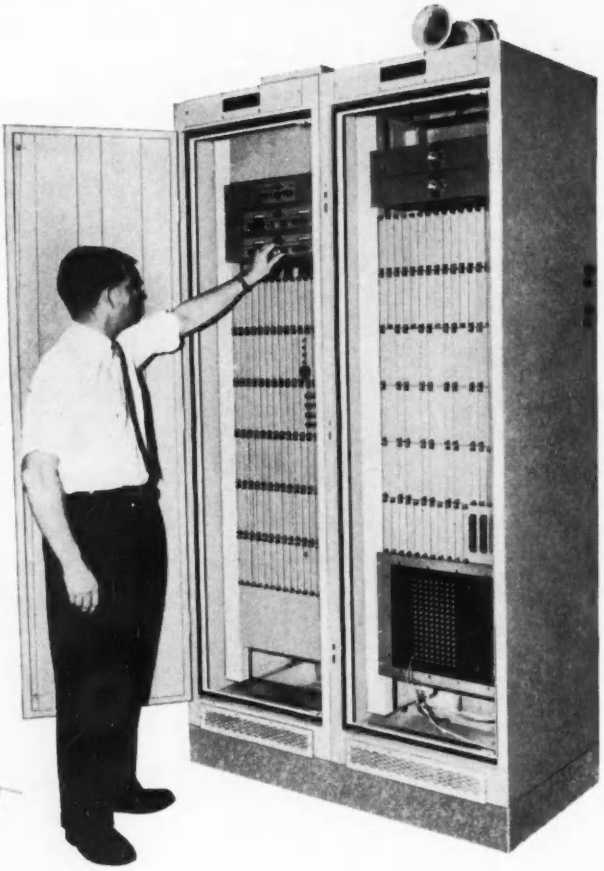
Westinghouse

KEY to functions performed by Bailey 700 Systems

A — Analog **A/D** — Analog and Digital
D — Digital **s** — sense and measure
d — display (indicate, record and/or log)
m — monitor (scan and alarm)
p — produce stored information for future use (tape, cards) **c**—compute **r**—control

● Installed ● On order

LOCATION	TYPE	FUNCTIONS
1. Chelan Co., Wash.	D	sdm
2. Chelan Co., Wash.	D	sd
3. San Francisco	A	sdc
4. Salinas, California	A	sdc
5. Los Angeles	A	sdc
6. Glendale, Ariz.	A	sdc
7. Alameda, N. M.	A	sdc
8. Amarillo, Texas	A/D	sdmc
9. Smithers Lake, Tex.	A	sdr
10. Orange Co., Tex.	A/D	sdmcr
11. Bronte, Tex.	D	sdm
12. Sioux Falls, S. D.	A	sdr
13. Oklahoma City	A	sdc
14. Harrah, Okla.	A	sdc
15. Muskogee, Okla.	A	sdc
16. Lafayette, La.	A	sdc
17. Jackson, Miss.	A	sdc
18. Cleveland, Miss.	A	sdc
19. Memphis, Tenn.	D	sdm
20. Paducah, Ky.	D	sdc
21. Sullivan, Ind.	A	sdc
22. Graham, W. Va.	A	sdc
23. Ashtabula, Ohio	A	sdc
24. Monroe, Mich.	A	sdcr
25. Rochester, N. Y.	A	sdc
26. Ludlowville, N. Y.	D	sdmp
27. Buchanan, N. Y.	A	sdr
28. Fairless Hills, Pa.	D	dm
29. Wilmington, Del.	D	dm
30. Washington, D. C.	D	dp
31. Hamilton Twp., N. J.	A	sdr
32. N. S. Savannah	A	sdr



BAILEY 700

ANALOG AND DIGITAL SYSTEMS IN ACTION

Installed or under construction, Bailey 700 Analog and Digital Systems are IN ACTION TODAY from coast to coast, providing integrated instrumentation systems accurately tailored to specific needs.

Note the variety of functions performed in these installations. Basic ingredients of all are electronic modules housed in standardized electrical cabinets, as shown here. This permits any combination of control, information or computing system elements to be combined and expanded as required to perform specific functions in individual installations. Wiring and maintenance is simplified —operator's console is freed of bulky equipment.

Ask your local Bailey engineer to arrange a visit and demonstration of a Bailey 700 System located near you, or at Cleveland. Or get IMMEDIATE details on the installation of greatest interest to you, by TWX—just jot down the number of the location you select on message form below and hand to your secretary. Reply will be transmitted at end of your message.

G153-2

QUICK FACTS BY TWX . . .

For name and IMMEDIATE details on installation of greatest interest to you, fill in number of location from map and have your TWX operator send this message:

WKLF 522

PLS SEND 700 SYSTEM DETAILS FOR LOCATION_____. PROCEED IMMEDIATELY WITH REPLY AT CONCLUSION OF THIS MESSAGE.

Name_____ Title_____

Company_____

City_____

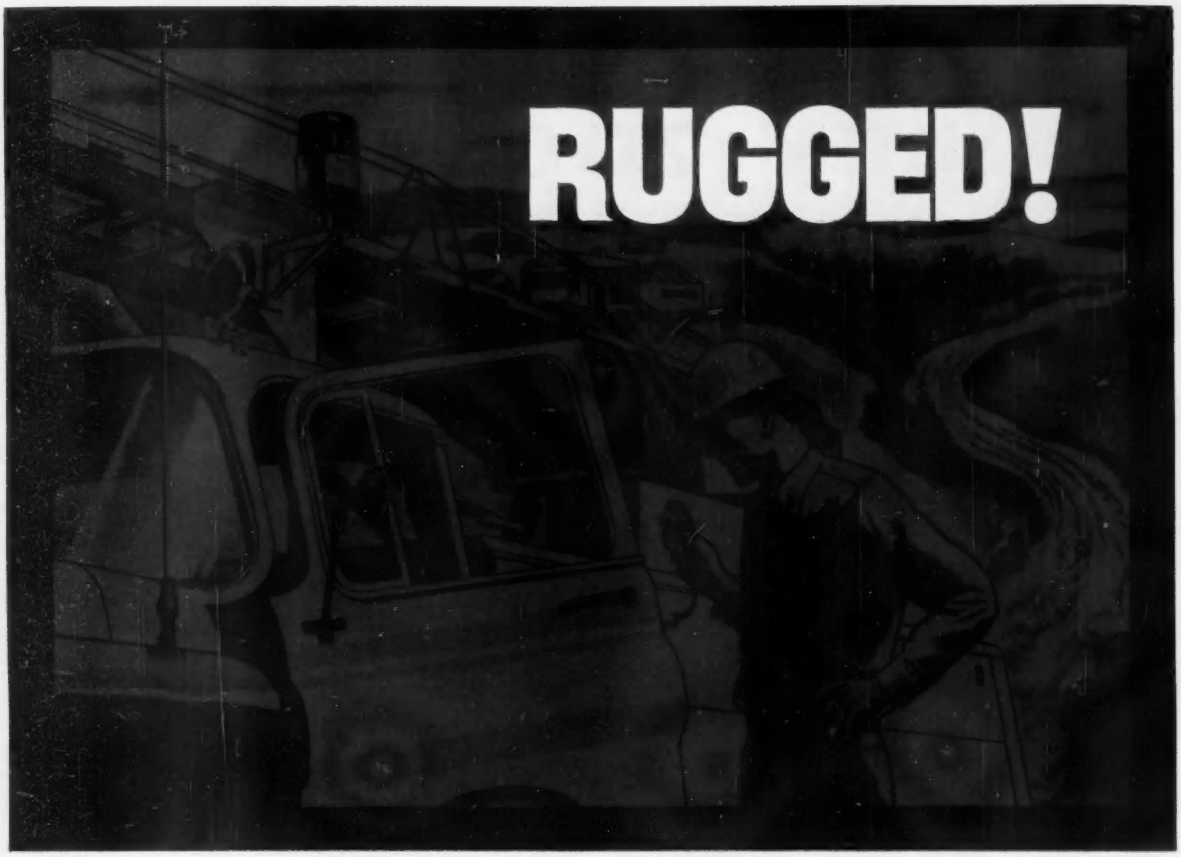
Instruments and controls for power and process

BAILEY METER COMPANY

1060 IVANHOE ROAD • CLEVELAND 10, OHIO

In Canada—Bailey Meter Company Limited, Montreal

BAILEY METERS

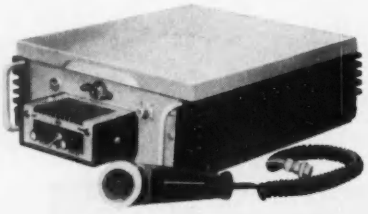


RCA "LD" 2-way radio has the guts to stand up to the toughest jobs!

There are rugged places where men, trucks and 2-way radios have to go, and each has to be a proven, reliable performer. In 2-way radio, this means quality must be built-in to take the gaff—quality such as only the leader in radio and electronics can offer—in the new RCA "LD" (Low battery Drain). Quality and price are combined in this dependable RCA equipment to give you the very best performance at the lowest cost. Use it on the roughest roads—Security Sealed Circuits are your assurance it can take it. Leave the radio on when your vehicle engine is turned off—battery drain is negligible—transistors are used in circuits where they have been proven to be most dependable.

It took experience and daring to bring you today's RCA 2-Way Radios. It meant discarding preconceived notions about circuits and redesigning with transistors in key places for reliability with economy. And it involved engineering a host of other advanced features to assure fine message intelligibility, and long component life at moderate cost.

Your RCA Communications Specialist will be glad to show you why the "LD", dollar for dollar, feature for feature, is today's greatest 2-way radio value. Or send coupon for further facts.



RCA

The Most Trusted Name in Radio

RADIO CORPORATION OF AMERICA

RADIO CORPORATION OF AMERICA
Telecommunication Center, Dept. RD-27
Meadow Lands, Pa.

☐ Please send me FREE literature on the new RCA Transistorized Mobile Radio.

☐ Have RCA Communications Specialist contact me and explain why this is today's best value in 2-way radio.

NAME_____ TITLE_____

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TYPE OF BUSINESS_____

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CITY_____ ZONE____ STATE_____

ALCOA ALUMINUM
ACCESSORIES ROUNDUP

Wider-range bolted full-tension dead end clamp

This is the new Cat. 302 dead end clamp. It's a companion to the recently introduced 301, with which it shares many common features. A full-tension clamp, the new 302 holds a minimum of 95% of the rated strength of conductors for sizes 2-6/1 to 266.8 18/1 ACSR. When paired with the 301 (handling sizes No. 6 to 2/0 ACSR), the two take the place of *three* previously available clamps for the range of sizes covered. Thus, it is possible to simplify inventories by standardizing on these *two* clamps.

The Cat. 302 clamp is cast in one piece of a high-quality, corrosion-resistant aluminum alloy. The two ½-inch U-bolts are also of high-strength aluminum alloy, which means that all parts surrounding the conductors have equalized coefficients of thermal expansion. The bolts are supplied with an Alumilite 205 finish and grease film. They withstand corrosion and are easy to tighten, since the threads are accurate and smooth. And because the bolts are long, to give plenty of clearance, installation is convenient.

For ease of aligning the cotter pin hole, the galvanized steel clevis pin has a clipped edge. The pulling eye, an integral part of the clamp structure, is large, so it's easy to use the hoist hook.

Off-the-shelf delivery of the new Cat. 302 dead end clamp is available. Your nearby Alcoa-Rome representative can supply information on delivery, price, or the clamp itself.

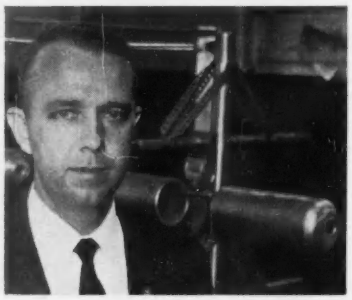
"Extra-large" accessories

The small compression joint—barely visible here—is a service entrance connector used on No. 2 conductor. The other one is designed for a full-tension splice of 2.32-inch diameter expanded ACSR. Many of today's installations—particularly EHV—require "extra-large" dead-ends, joints, armor rods and other accessory parts. Alcoa meets the need for small, medium, large or even "extra-large" accessories.

→

Stockbridge dampers–Aeolian vibration control

by C. B. Rawlins, Research Engineer, Alcoa Research Laboratories, Massena, N.Y.



The Stockbridge damper is an energy dissipation device removing the energy of vibration imparted to a conductor by wind. It consists of a clamp attached to the conductor and a stranded steel cable connecting a pair of bell-shaped inertia weights to the clamp. Conductor vibration induces a relative motion between the clamp and the inertia weights. This in turn causes flexure of the steel cable, resulting in dissipation of mechanical energy by friction between the strands of the damper cable.

The effectiveness of the damper depends strongly upon how efficiently the vibration motion of the conductor can be translated into the flexure of the damper cable. The damper will dissipate energy for any wind velocity at which vibration of the conductor is translated into sufficient flexure of the damper cable to produce interstrand slipping.

In contrast to most tuned damping devices, which operate best only near their natural frequencies, the Stockbridge damper is designed for efficient transfer and dissipation of energy at frequencies far from its two natural frequencies. In fact, the most efficient performance generally takes place at frequencies which are above the natural frequencies.

Under most field conditions, properly selected dampers, properly spaced, are effective in eliminating damaging vibration. Damper sizes for various conductors are listed in Alcoa catalog DC2A. Spacing rules are specified in the publication "Notes on the Application of Stockbridge Dampers."

For unusual vibration conditions or line construction, special engineering consultation is available through Alcoa-Rome sales offices.

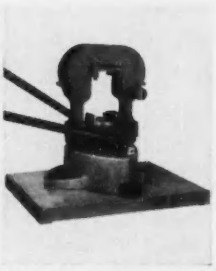
Hydraulic compressor versatility

What types of compressors (and how many of each) are enough? Your answer to both questions depends on the nature and scope of your operations. This is why we offer such a wide choice in compressors. Check the latest published data from Alcoa on this subject; there are five hydraulic compressors alone listed as current. Herewith is a brief run-down.

MODEL 12A • Small and light weight (a mere 11 pounds), it's suitable for ground or aerial operation. Hand operated, it provides a thrust of 12 tons. It features conveniently located controls, adjustable die gap, rapid piston advance and a C-head that's rotatable through 180 degrees.

Model 12HA • This one is also lightweight and has a full 12-ton thrust. Designed primarily for swift installation of ALCOA Tubular Compression Accessories. Its small size and the fact that it can be operated in any position by a remote pump make it well suited for use in close or cramped quarters or with Alcoa's new hydraulic hot stick.

Model 60A • A proven rugged, fast, convenient portable tool for ground or aerial use, it delivers 60 tons of thrust for maintenance or construction with any commercial conductor sizes and tubular accessories. A remote pump can be hand operated or driven by either electric or gasoline power.



Model H2 • With a thrust of 100 tons, this heavy-duty tool is capable of handling a full range of conductors. The compressor can be operated by integral hand pump or with a powered hydraulic pump. The two hand pumps provide a high speed for raising the piston until it contacts the accessory to be installed, and a low speed for closing the dies.

Model H2H • A simplified and lighter-weight version of the H2, this tool can be operated in any position. It is designed specifically for use with a remote pump for extra speed and versatility. Pumps for hand, electric motor, or gasoline engine operation are available.

Summing up: Alcoa's new Cat. 302 dead end clamp becomes a companion to the Cat. 301—together taking the place of *three* previously available clamps.

Extra-large accessories put a wide range of sizes at your disposal.

Stockbridge dampers are designed for efficient energy dissipation over a wide range of frequencies.

Alcoa's broad line of compressors provide the answers to the questions of what type? how many?

Your nearby Alcoa-Rome salesman is eager to supply additional information on any or all of these items. Why not call him today? For the name and address of our nearest representative, write to Rome Cable Division of Alcoa, Dept. ACR-4, Rome, N. Y.

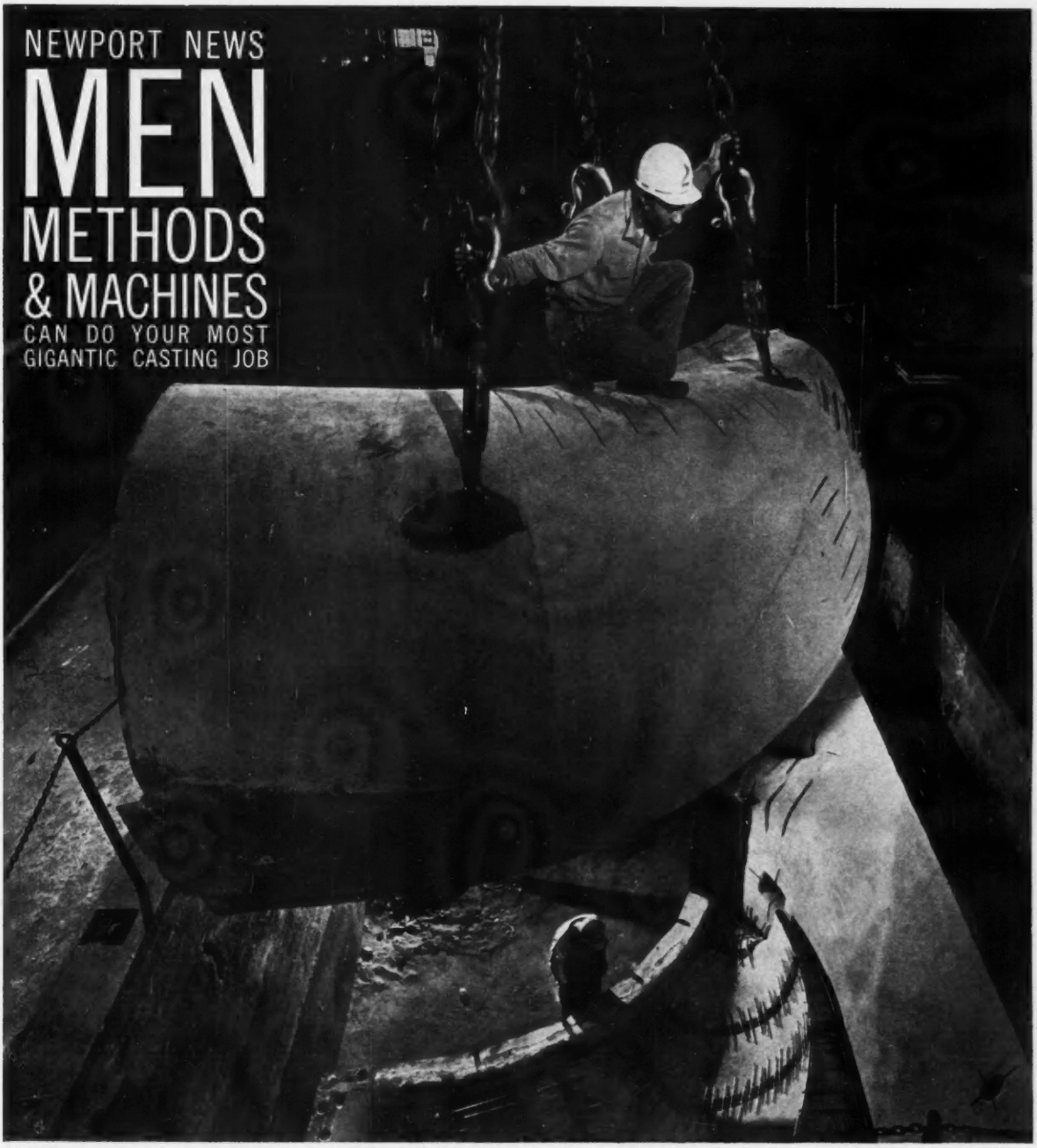
ALCOA
ROME CABLE
DIVISION

This is an advertisement

NEWPORT NEWS

MEN METHODS & MACHINES

CAN DO YOUR MOST GIGANTIC CASTING JOB



Mold for a section of a turbine stay ring for the Hartwell Power Plant. It is the largest one-piece Y-casting ever produced by Newport News.

It takes all three—men, methods and machines to tackle a job as big as this one! Newport News has completed many of them including six hydraulic turbines for the Niagara Project, four for the Hartwell Power Plant, and many others.

Newport News not only cast this giant unit but also milled it—and built the boring mill that did the work! No challenge is too great.

The secret of its leadership in the fabrication of heavy equipment is its staff of highly trained engineers and technicians, thousands of skilled workmen and 225 acre plant capable of turning out such projects as hydraulic turbines and valves, vacuum or pressure vessels for the petrochemical industry, bridge caissons, wind tunnels, and pulp and paper equipment.

Consult Newport News for preliminary recommendations at no obligation.

Newport News
SHIPBUILDING AND DRY DOCK CO.
NEWPORT NEWS, VIRGINIA

2170 SUBSTATIONS AND 40 YEARS LATER...

SOUTHERN STATES IS STILL LOOKING FOR THE MAGIC FORMULA

A great deal has been said about *standardized substations*. As much as we like the basic idea, the one thing we have learned is that there is no cut-and-dried, assembly-line, easy way to produce substations on an industry-wide basis.

We've been at it 40 years, producing more than 2170 substations of all kinds, and it has always been tough for us!

Even stations with essentially the same assignments have endless arrangements. Infinite combinations of design preclude standardization in the true sense of the word. The exception is where individual utilities have developed their own standardized substation programs. Otherwise substations must be virtually custom-made.

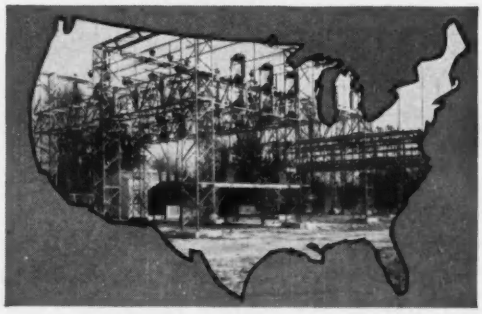
True, hundreds of designs in our files are helpful. Many standard components are picked up and used, with ultimate savings to our customers. And the years of practical experience of our design staff guides us, and our customers, around many pitfalls.

But you can't escape the fact that supplying substations requires these basic functions: skillful engineering, careful detailing, precise coordination of production schedules, and delivery on time. At least, that's what we've learned 2170 substations and 40 years later. And that's how we approach every substation assignment.

On this basis, you might like to do business with us. We'll welcome your inquiry. Just call your Southern States representative or write to us direct.

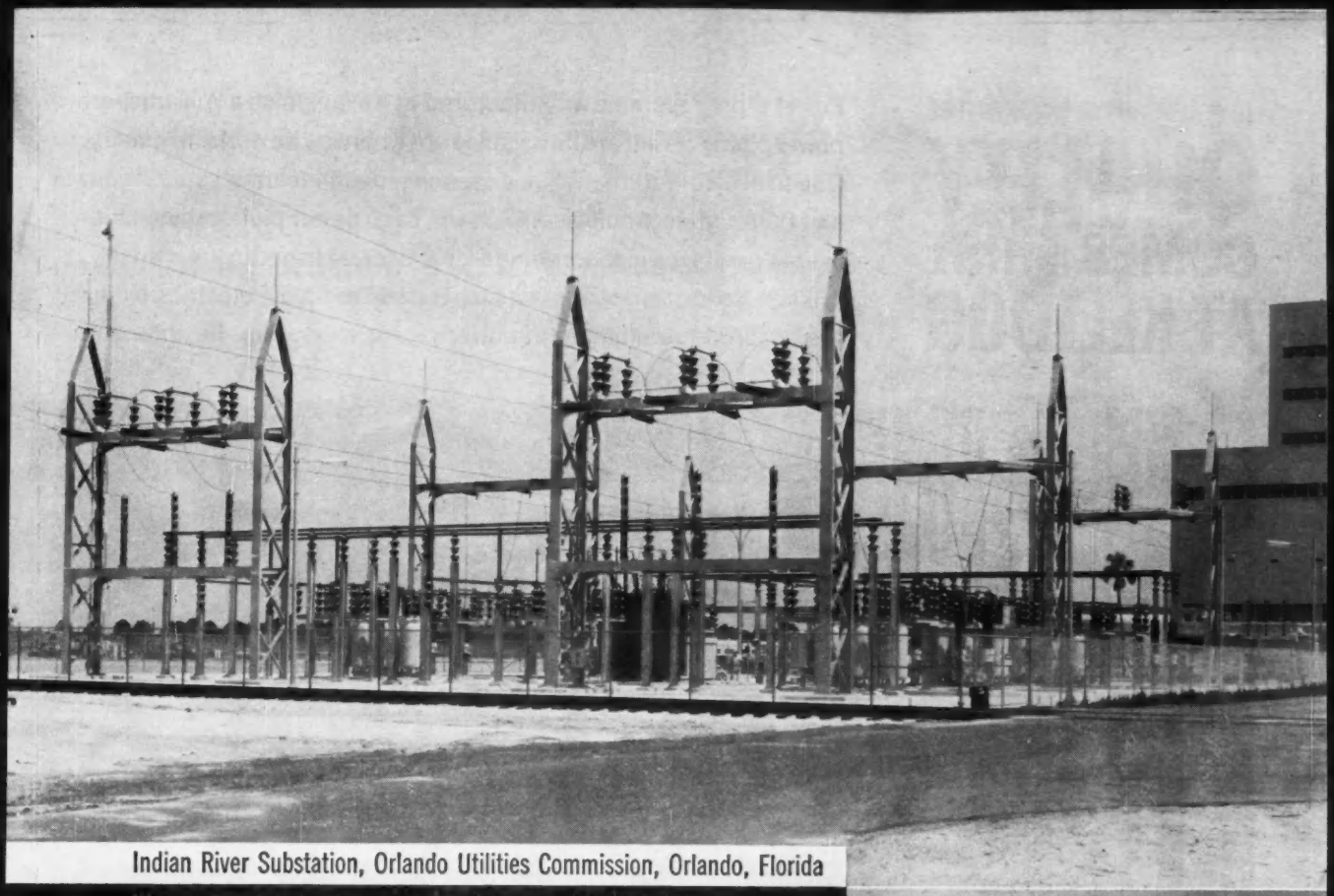
SOUTHERN STATES SUBSTATIONS ARE IN USE ALL OVER THE NATION

During the past 40 years Southern States has produced 2170 outdoor substations for hundreds of different customers. They range from small 5000 kva units to switchyards exceeding 1-million kva, and include substations for the nation's newest atomic systems. Regardless of size, Southern States scrutinizes every detail —from single-line wiring diagram to the finished station.



SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto



Indian River Substation, Orlando Utilities Commission, Orlando, Florida

Warson Substation, Union Electric Company, St. Louis, Missouri

IN POWER PIPING MANUFACTURE

QUALITY COMES FIRST AT KELLOGG

Power piping systems manufactured at Kellogg's new Williamsport power piping center are unequalled anywhere in the world for quality. Due to skilled workmanship, experienced engineering supervision, and thorough technological back-up, each power piping system delivered meets the highest standards ever established in the industry.

When Kellogg is also responsible for field erection, electric utilities are assured the ultimate in power piping service life for the mini-

mum over-all power piping investment. Kellogg's Power Piping Division welcomes the opportunity to tell you more about its power piping center in Williamsport, Pa., and its manufacturing services located there. Write for a new brochure—soon to be available.

POWER PIPING DIVISION / THE M. W. KELLOGG COMPANY

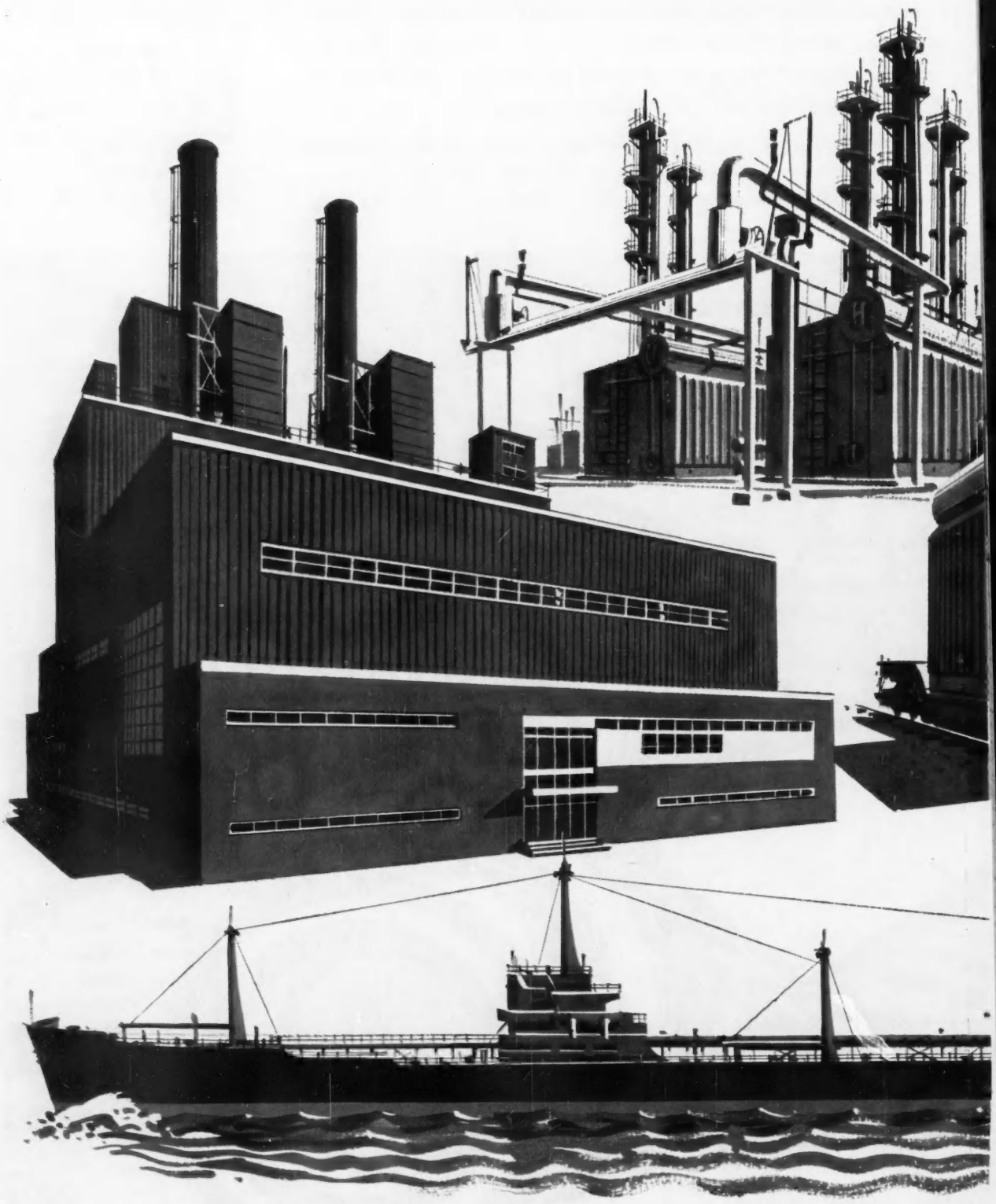
A Subsidiary of Pullman Incorporated

Plant & Headquarters: Williamsport, Pa. Sales Offices: 711 Third Avenue, New York 17, N.Y.

POWER PIPING

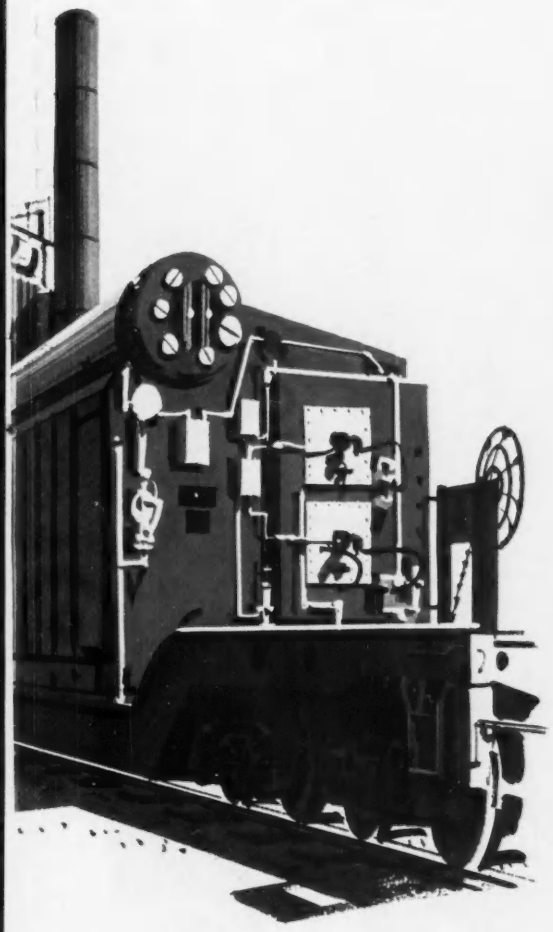
M KELLOGG W

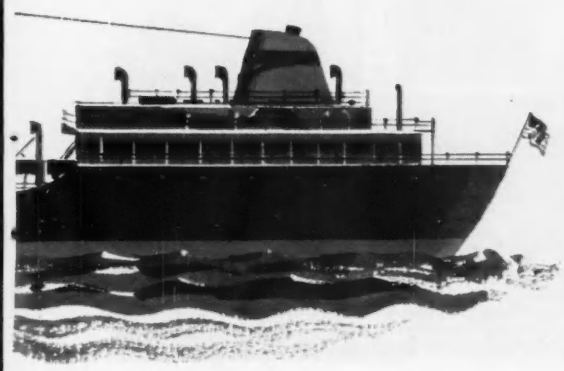
HEADQUARTERS



POWER PLANT PRODUCTS HEAT ENGINEERED BY FOSTER WHEELER:

Central Station and Industrial Steam Generators • Steam Condensers and Pumps • Cooling Towers
Pulverized Fuel Systems • Feedwater Heaters • Packaged Steam Generators • Nuclear Components





A broader power base to serve you

Through contributions in every field where steam power is used, Foster Wheeler has accumulated knowledge and experience that are yours today in all Foster Wheeler equipment and services.

FW-built steam generating units are identified with the central stations of leading U.S. utilities. Foster Wheeler has designed, engineered and built more nuclear steam generators and pressurizers than any other manufacturer in the world. And FW is the leading U.S. supplier of marine steam generating equipment.

In factories, oil refineries, chemical plants and every other type of installation requiring useful heat, Foster Wheeler is in the top rank of companies supplying heat transfer and steam power equipment.

When such equipment becomes your need, assure yourself of the benefit of FW's broader experience with the *full range* of steam producing components.

FW engineers, fabricates and erects them all: utility and industrial steam generators, feedwater heaters, steam condensers, evaporators, pulverizers, cooling towers, specialized pressure vessels and industrial processing plants.
Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N.Y.

FOSTER FW WHEELER

NEW YORK TORONTO LONDON PARIS MILAN TOKYO

70% MORE WORKING RANGE with

Holan's Unlimited* Action HD-50 Elbow

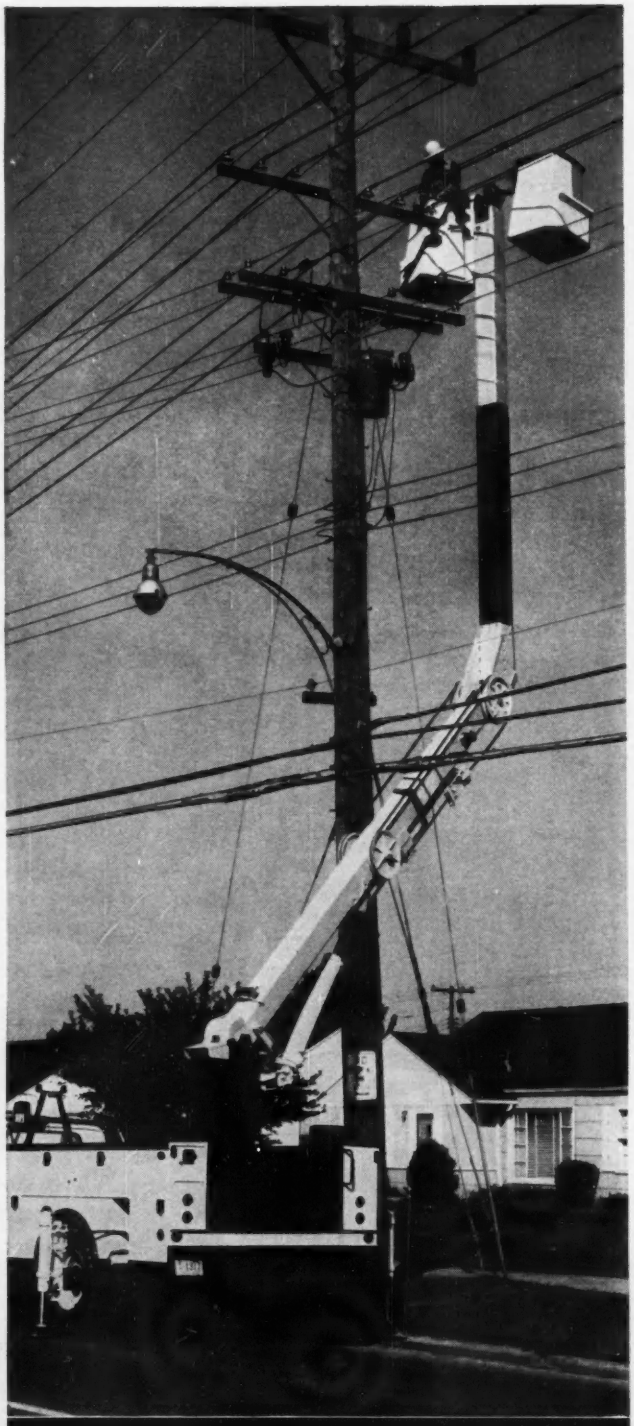
Holan's unlimited* action Elbow will go straight up . . . or straight out . . . or 13 feet below street level. It has 70% more working range than limited action aerial arms . . . and will put your linemen in a greater variety of working positions than any other aerial arm on the market today.

But it requires "beefed-up" chassis reinforcement and special supporting jacks to offset the tremendous loads. Features like these increase the original cost . . . but less truck maneuvering saves time and dollars in the long run . . . and more than justifies the additional cost of the full-action Holan Elbow.

Safety demands rigidity . . . precise control of the upper arm . . . and fiberglass buckets certified tested at 50,000 volts (A.C.). The upper arm of the Holan Elbow will withstand a one-minute, 200,000-volt (A.C.) dry bucket-to-ground test.

If you require less than full action, see our medium duty or light duty limited action Elbows and our new 65-foot model. And for the very latest in Holan aerial equipment, be sure to ask about the new Holan "Squirt Boom."

270° UPPER ARM AND 120° LOWER ARM TRAVEL



Parked at the curb, a limited action, two-man bucket aerial arm could not possibly get in this working position. An unlimited* action Elbow goes under the low-hanging communication cables, then up the property side of the pole without moving the truck.

* Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

Blackburn Laboratories Develop New, Improved contax®

(Oxide-inhibiting compound)

HARMLESS TO LINEMEN'S GLOVES AND IMPROVES CONNECTION PERFORMANCE

Extensive laboratory tests by Blackburn, confirmed by an independent manufacturer of rubber goods, prove conclusively that BLACKBURN'S Contax has no adverse effect on linemen's rubber gloves and blankets.

In addition, Contax gives improved connection performance. It penetrates the oxides on conductors to reduce connection resistance. It inhibits oxidation and galvanic corrosion by sealing out moisture and air from the connection surfaces.

Contax comes in crack-proof, see-through, plastic squeeze bottles. It's a non-petroleum, synthetic polymer grease with suspended zinc particles . . . has an extremely low moisture absorption rate, and is usable over a wide temperature range. Contax is non-toxic and flame resistant . . . will not harm the skin.

For detailed test data, send for Data Folder #6009.

Jasper BLACKBURN Corporation

1525 Woodson Road **St. Louis 14, Missouri**

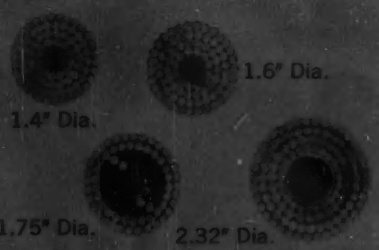
Transmitting increasingly large blocks of power over long distances without service interruption is the objective of the engineers who designed the

PENELEC 460KV

thirteen-mile experimental line from Claysburg to Saxton, Pa. Almost all of the components — structures, conductors, insulators, hardware, etc. — were specially manufactured or adapted to accommodate extra-high voltages, as well as excessive mechanical stresses imposed by rugged terrain, high tensions, and extreme weather conditions. How each component will perform under extended EHV operation is yet to be determined. Collaborating with Pennsylvania Electric Company in this ambitious experiment is the Research & Engineering Center of Preformed Line Products Company, who have contributed for installation and comparative analysis a group of protective products designated as . . .

Planned Line Protection for

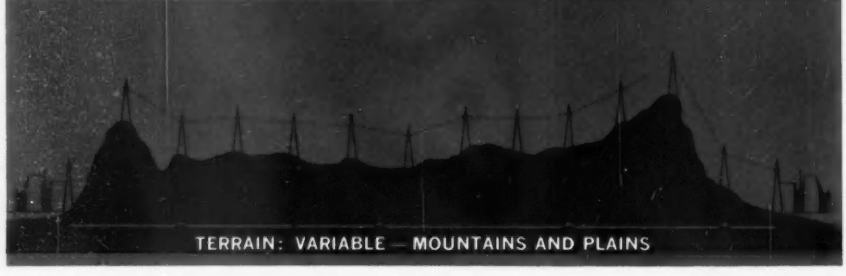
TENSIONS: UP TO 27,500 LBS.



CONDUCTORS: EXPANDED CORE ACSR

VOLTAGE: 460 KV

WEATHER: VARIABLE



TERRAIN: VARIABLE — MOUNTAINS AND PLAINS

The products in this advertisement are manufactured under one or more of the following: U. S. Patent No. 2,609,653; 2,691,865; 2,761,273; 2,722,393; and 2,959,632; other patents pending.

is a trademark which is registered in the U.S. Patent Office and is the property of Preformed Line Products Company.
PREFORMED, GUY-GRIP and ARMOR-GRIP are additional trademarks of Preformed Line Products Company.

(1) Clipping in a two-conductor bundle of 1.75" expanded ACSR with ARMOR-GRIP Suspension (AGS), the assembly that floats the conductor on a cushion of neoprene and eliminates line failures by distributing stresses over a wide area support. PREFORMED Rod End Corona Shields eliminate corona and radio influence at operating voltages.

(2) GUY-GRIP Dead-Ends are used at the top and anchor locations of ½" and ⅝" EHS guy strand which support a lightweight steel "H" frame structure. Dead-Ends at the top are specially designed with an extra large loop to accommodate 21" diameter tubular steel uprights.

(3) Lineman, clipping in 1.75" bundled ACSR conductor at an angle structure, applies PREFORMED Armor Rods to protect conductors from damage which might result from extended vibration, chafing, arc-over, and concentrated clamping stresses. No tools are required to apply PREFORMED Armor Rods . . . an added benefit on bundled conductors.

(4) Construction crew attending an orientation and practice session on application procedures of PREFORMED Spacers for bundled conductors prior to their installation on the test line. This unique spacer design prevents midspan hits or intertwining of conductors, and reduces Aeolian vibration.

PREFORMED RADIO TELEMETRY MONITORS LINE CHARACTERISTICS

(5) PREFORMED LINE PATROL (jeep-mounted) and DYNALAB on location at PENELEC. The two mobile laboratories are engaged as a team routinely investigating the effects of Aeolian vibration upon the energized 460 KV line. Both laboratories carry electronic instrumentation equipment for receiving, discriminating, and recording environmental conditions which are transmitted by radio from a PREFORMED Mark II Transmitter mounted overhead in the vicinity of the test points. The DYNALAB, equipped with elaborate instrumentation, is the "mother" lab. Its function is to make extensive study of vibration conditions at a fixed location.

(6) The maneuverable jeep-mounted PREFORMED LINE PATROL "scouts" data at remote structures, making simultaneous readings for later comparison with information accumulated by the DYNALAB. Thus, correlation of data received from various points along the line can be made, making the DYNALAB investigations more meaningful.

Write for Booklet-of-the-Month
"PLANNED LINE PROTECTION for EHV"

PREFORMED LINE PRODUCTS COMPANY

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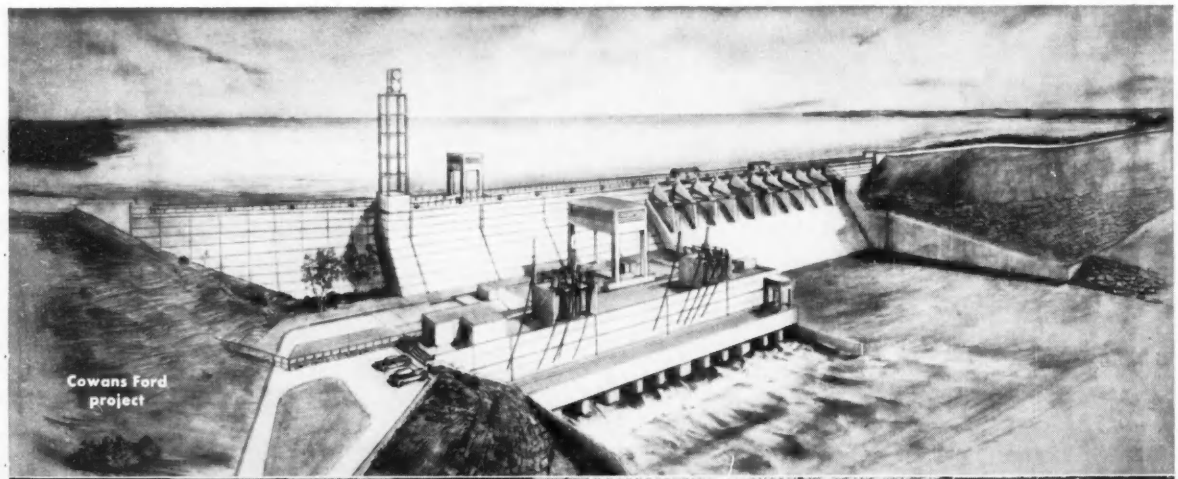
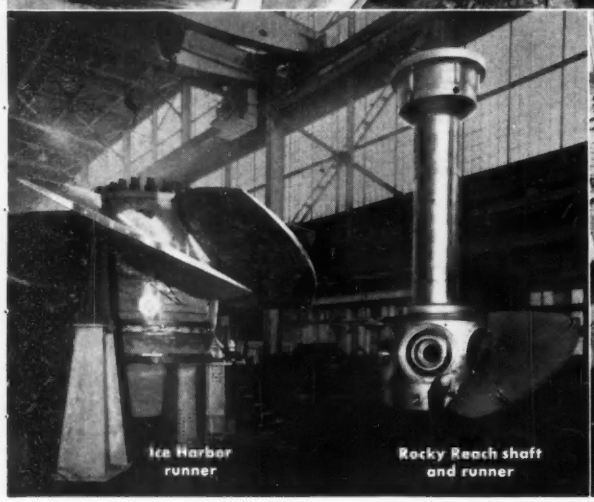
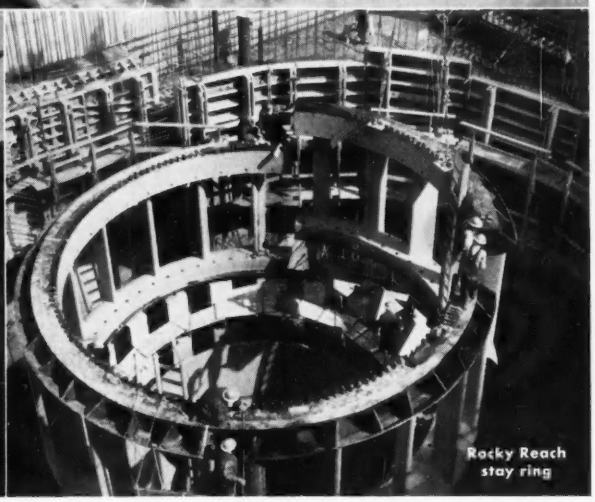
ALLIS-CHALMERS







high-head Kaplans for peaking

—previous record-breakers also by Allis-Chalmers

Cowans Ford is the outstanding illustration of Kaplan turbines used to provide peaking capacity. Duke Power Company, with Chas. T. Main Inc. as consulting engineers, has selected A-C Kaplan turbines for operation at 115-ft. head. Each of the three units is guaranteed to provide a maximum of 153,000 hp. Actual operation will involve only a short time each day, meeting peaking requirements of the system which is predominantly steam. The resulting average load factor, *less than 5%*.

KAPLAN RECORD-BREAKERS

Cowans Ford — the third in a series of outstanding A-C Kaplan turbine installations. These units exceed those at both Ice Harbor and Rocky Reach in rated capacity and head. All are similar in construction (those at Cowans Ford are slightly smaller in physical size). Allis-Chalmers diversified experience to date includes over 240 Kaplan turbines — *a record 6 million hp.*

Rocky Reach—public utility district supplied with seven Kaplan turbines, each 140,000 hp (under 92-ft. head).

Ice Harbor — Corps of Engineers installation recently provided with three new A-C Kaplans for operation at 89-ft. head. These held the record with 143,000 hp per turbine until Cowans Ford.

In every facet of hydro generation, people count on record performance and experience from Allis-Chalmers. For assistance anytime, contact your local A-C representative or write to **Allis-Chalmers,** Hydraulic Division, York, Pa. A-1383

Editorial Comment

FEBRUARY 27, 1961

Industry Sets Sights on Growth

Expressions of business confidence are rather hard to come by these days. That's why the second part of our annual statistical report appearing in this issue is such a strong affirmation of the electric utility industry's faith in the long-range prospects for our economy.

In Part I on January 23, we reported that the industry plans to spend 5.1% more on expansion in 1961 than in 1960 despite the spate of gloomy economic forecasts abounding at budget time last fall. Now, in Industry Statistics—Part II, we find utilities already plan to spend more in the next five years than they spent in the last five—clearly indicating intentions to make up for the hardly noticeable "stretchout" which took place in some expansion programs over the past few years. True, these are only preliminary budget estimates but they are backed up by solid and expensive plans to add better than 59 million kw of new generating capacity sometime in the foreseeable future. Even more concrete are the plans to install 35 million kw of this total before year-end 1963, thus raising the nation's total generating capacity to about 202 million kw by then.

Moreover, utility plans were expanded during 1960 despite the disappointing debut of the "Soaring Sixties." For instance, this time last year the industry planned to install 22,962 Mw of new generating capacity "sometime after 1962." However, within the past year they firmed up a good portion of these long-range plans by scheduling 10,812 Mw or 47% of this for 1963. In addition, they still report plans to add another 24,616 Mw "sometime after 1963." And lest you think changes in plans for '61 and '62 are responsible, consider that the total additions planned for 1961 and 1962 now stand at 23,799 Mw compared with 22,333 Mw a year ago.

The reasons for such optimism are also contained in Part II of our annual report. The reasons are simple and obvious and they all add to growth—even during the business plateau of 1960. For instance, industry kwhr sales racked up a 6.1% gain last year and revenues followed along with a 6.2% jump—both helped by an increase of slightly more than a million new customers. With growth such as this the industry can ill afford to rest on its laurels and we are happy to report they are not planning to.

Has Udall Impaired His Standing With Congress?

Interior Secretary Stewart Udall's boast that he got "a result or two" in his own private campaign to gain support for the Administration's position on the House Rules Committee change does raise questions.

Sen Francis Case (R-S. D.) was quick to respond, asking whether Udall wanted to clarify his statement.

Udall acknowledged that he had spoken to four Republican Congressmen in connection with the Rules Committee issue, but said "nothing improper passed between us."

We have an idea that Udall's little foray on Capitol Hill may rise to haunt him in future appearances before Congressional Committees.

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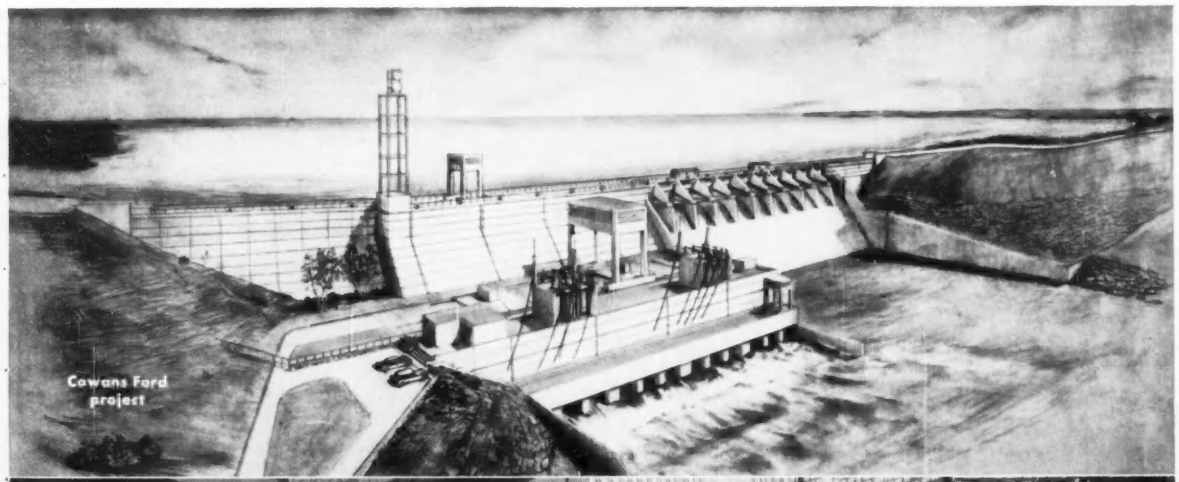
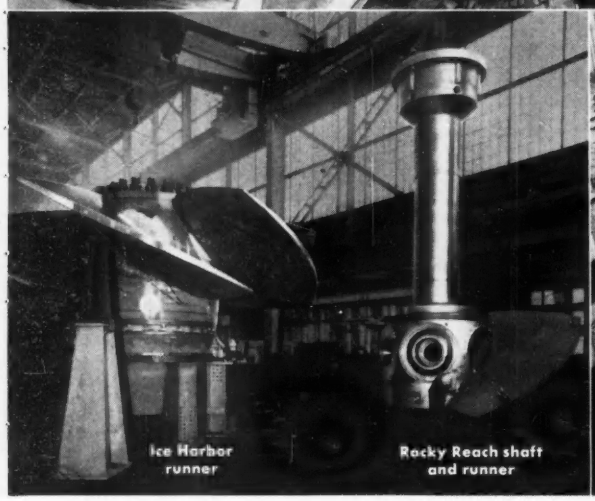
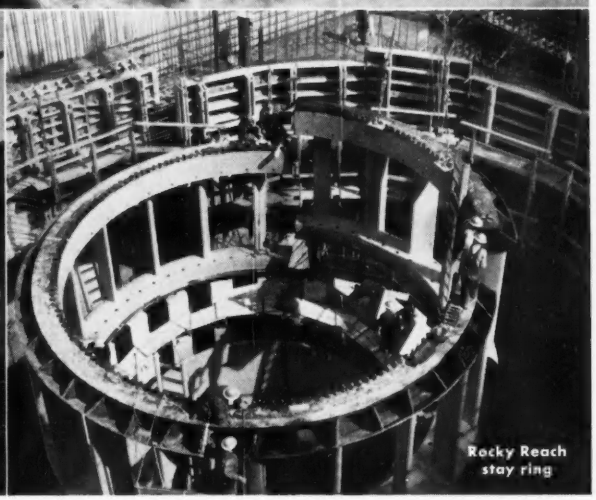
ALLIS-CHALMERS







high-head Kaplans for peaking

—previous record-breakers also by Allis-Chalmers

Cowans Ford is the outstanding illustration of Kaplan turbines used to provide peaking capacity. Duke Power Company, with Chas. T. Main Inc. as consulting engineers, has selected A-C Kaplan turbines for operation at 115-ft. head. Each of the three units is guaranteed to provide a maximum of 153,000 hp. Actual operation will involve only a short time each day, meeting peaking requirements of the system which is predominantly steam. The resulting average load factor, *less than 5%*.

KAPLAN RECORD-BREAKERS

Cowans Ford — the third in a series of outstanding A-C Kaplan turbine installations. These units exceed those at both Ice Harbor and Rocky Reach in rated capacity and head. All are similar in construction (those at Cowans Ford are slightly smaller in physical size). Allis-Chalmers diversified experience to date includes over 240 Kaplan turbines — *a record 6 million hp.*

Rocky Reach—public utility district supplied with seven Kaplan turbines, each 140,000 hp (under 92-ft. head).

Ice Harbor — Corps of Engineers installation recently provided with three new A-C Kaplans for operation at 89-ft. head. These held the record with 143,000 hp per turbine until Cowans Ford.

In every facet of hydro generation, people count on record performance and experience from Allis-Chalmers. For assistance anytime, contact your local A-C representative or write to **Allis-Chalmers,** Hydraulic Division, York, Pa.

A-1383

Editorial Comment

FEBRUARY 27, 1961

Industry Sets Sights on Growth

Expressions of business confidence are rather hard to come by these days. That's why the second part of our annual statistical report appearing in this issue is such a strong affirmation of the electric utility industry's faith in the long-range prospects for our economy.

In Part I on January 23, we reported that the industry plans to spend 5.1% more on expansion in 1961 than in 1960 despite the spate of gloomy economic forecasts abounding at budget time last fall. Now, in Industry Statistics—Part II, we find utilities already plan to spend more in the next five years than they spent in the last five—clearly indicating intentions to make up for the hardly noticeable "stretchout" which took place in some expansion programs over the past few years. True, these are only preliminary budget estimates but they are backed up by solid and expensive plans to add better than 59 million kw of new generating capacity sometime in the foreseeable future. Even more concrete are the plans to install 35 million kw of this total before year-end 1963, thus raising the nation's total generating capacity to about 202 million kw by then.

Moreover, utility plans were expanded during 1960 despite the disappointing debut of the "Soaring Sixties." For instance, this time last year the industry planned to install 22,962 Mw of new generating capacity "sometime after 1962." However, within the past year they firmed up a good portion of these long-range plans by scheduling 10,812 Mw or 47% of this for 1963. In addition, they still report plans to add another 24,616 Mw "sometime after 1963." And lest you think changes in plans for '61 and '62 are responsible, consider that the total additions planned for 1961 and 1962 now stand at 23,799 Mw compared with 22,333 Mw a year ago.

The reasons for such optimism are also contained in Part II of our annual report. The reasons are simple and obvious and they all add to growth—even during the business plateau of 1960. For instance, industry kwhr sales racked up a 6.1% gain last year and revenues followed along with a 6.2% jump—both helped by an increase of slightly more than a million new customers. With growth such as this the industry can ill afford to rest on its laurels and we are happy to report they are not planning to.

Has Udall Impaired His Standing With Congress?

Interior Secretary Stewart Udall's boast that he got "a result or two" in his own private campaign to gain support for the Administration's position on the House Rules Committee change does raise questions.

Sen Francis Case (R-S. D.) was quick to respond, asking whether Udall wanted to clarify his statement.

Udall acknowledged that he had spoken to four Republican Congressmen in connection with the Rules Committee issue, but said "nothing improper passed between us."

We have an idea that Udall's little foray on Capitol Hill may rise to haunt him in future appearances before Congressional Committees.

Until he can convince Congress that he is not playing politics with natural resource development, some of his old colleagues may be very wary of his testimony as to the engineering and economic feasibility of Interior Department projects. They also will want to know the political implications of his proposals.

NRECA and Kennedy Administration

NRECA convention exchanges ideas with the Administration and endorses new frontiers in federal power development

The Kennedy Administration and the National Rural Electric Cooperative Assn started out on a honeymoon journey from Dallas earlier this month. True, not all the members of the family were on hand to wish the couple well, but the weather was so nice and the display of young love so profuse that little else mattered.

Climax of the pre-nuptial festivities came with the dramatic last-minute announcement from the platform of the 19th annual NRECA convention in Dallas that NRECA staff member, Richard A. Dell, was to be appointed deputy administrator of the Rural Electrification Administration. But the wooing had started earlier in the week with a lengthy letter of greetings and best wishes from Pres John F. Kennedy and the constant attendance at the convention of REA Administrator-designate Norman Clapp. Missing from the four-day Dallas conclave of some 7,000 rural electric cooperative representatives were representatives of any of the top new men of the Interior Department. What made this particularly noticeable was that the new Assistant Interior Secretary for Water and Power, Kenneth Holum, had been closely associated with cooperative activities before going to Washington.

ELLIS: Frequently praised

While the promising relationship between NRECA and the Kennedy Administration over-shadowed many of the other activities at the annual NRECA meeting, the delegates and their leaders did discuss some pressing problems that enter into the day-to-day operation of rural electric co-ops, and the problems that plague many rural sections of the country. Particularly stressed were: **(1)** The advance of the rural depression and the decrease of the farm population, **(2)** The firming up of power supply for rural electric cooperatives, and **(3)** The protection of the service territory of the rural electric co-ops. NRECA General Manager Clyde Ellis, in a moving speech, designated these three problems as the most critical and the most pressing. Other speakers alluded to them, and offered tentative approaches to their solution.

But what impressed delegates most was the frank exchange of views between NRECA and the Kennedy Administration.

What President Kennedy Offers

In his letter to NRECA Pres Walter Harrison, President Kennedy outlined his general approach to the rural electric cooperatives in these words:

"We have much to do, and it is time to take action. We are going to move ahead with multipurpose river development. We shall seek a way to link the power systems of our great rivers. We are going to make new starts now on reclamation projects.

"We are going to develop a realistic and constructive program to aid depressed areas in the United States and to assist the small family farmer who is finding it difficult or impossible to feed and clothe his family adequately. We shall seek ways to assure an abundant supply of electric power at the lowest possible cost for all rural people, and to help people use that power effectively to raise productivity and their standard of living . . ."

The specific attitude of the Kennedy Administration toward the rural electric co-ops was spelled out in a talk by John A. Baker, director of agricultural credit services.

Quoting from a memorandum recently issued by Agriculture Secretary Orville Freeman, Baker set forth these main points of Administration policy:

(1) Each application for an REA loan will be considered on its merits and every loan which meets the legal, feasibility, and other requirements of the Rural Electrification Act is going to be approved when funds are available.

(2) The REA Administrator is going to make all the REA loans, acting within the general policy directions of the Agriculture Secretary and the director of agricultural credit, and within the requirements of the Rural Electrification Act.

(3) The Administration is pledged to finish the task set by Congress for the rural telephone loan program.

(4) The Administration is going to encourage additional REA-financed generation and transmission facilities wherever necessary to secure an abundance of power for growing rural needs at the lowest possible rates. REA-financed G&T systems will help this Administration to develop yardsticks for measuring the rates of private utility systems.

(5) The Administration favors continuation of the 2% interest rate for REA loans.

(6) The Administration favors strict enforcement of the public preference clause for power from federally-financed plants.

(7) The Administration is pledged to foster the development of efficient regional power systems from all sources—including water, tidal, and nuclear—to supply low-cost electricity to public, and cooperative and other investor-owned power systems. The Administration is convinced that the development of natural resources and the generation and transmission of electric power in federally-owned facilities

Join Hands in Dallas

has a direct and important impact on the rural electrification program as well as on the sound economic development of rural areas.

(8) The Administration is reviewing the Eisenhower budget with a view to making sure that adequate loan funds will be available to rural systems to meet their total needs.

(9) The Administration supports the efforts of cooperatives, state associations, and the NRECA in carrying on a wide range of technical and management training programs. REA is going to cooperate with these programs, including the NRECA institutes, in every appropriate way within the limits of the Rural Electrification Act and the REA budget.

(10) The Administration will do what it can, within its legislative authority, to help cooperatives protect their territorial rights.

With his nomination still pending at the White House, REA Administrator - designate Norman Clapp, a former Democratic party official and former newspaper publisher in Wisconsin, spent the four days at the convention in a never-ending series of conferences with delegates. The youthful Clapp (46) made two appearances on the platform to proclaim his intention of working with the co-ops and NRECA.

Because his nomination had not yet been sent to the Senate for confirmation, Clapp avoided any policy statement of his own. However, Ellis reported to the closing session of the convention that Clapp had "expressed the desire to work with us to revitalize REA." Ellis added his own indorsement of Clapp, saying that he was "favorably impressed with his sincerity and his interest in rural cooperative activities." The NRECA membership had earlier passed a resolution commending President Kennedy for choosing Clapp for the job.

What NRECA Wants

Broad and liberal as were the Kennedy Administration offers, they still fell far short of the NRECA desires. The two seemed to be fairly close together on such basics as continuation of the 2% interest rates on loans to co-ops, more money for generation and transmission loans, the need for rural development, and new starts on hydroelectric projects, but the NRECA resolutions, passed with hardly a word of dissent, appeared to cry out for more specific promises.

Nez Perce Endorsed

It seemed almost a shame that Interior Department had failed to send a representative to the meeting, as many of the resolutions appeared to be addressed to that department. Following are a sample of the scores of resolutions passed at the final business session.

(1) The association endorsed the Nez Perce project proposed by the Washington Public Power Supply System, asked for a crash program of fisheries research to make the project feasible, and opposed the competing High Mountain Sheep project of the investor-owned electric utilities.

(2) NRECA supported the principle of the US-Canadian Treaty providing for integrated development of the Columbia River Basin and urged the Senate to ratify the treaty.

(3) NRECA urged Congress and the Interior Department to undertake a comprehensive study of the power and energy potential of pumped storage units at federal reservoir sites, work out legislative policies to govern licensing such sites, and make sure that such policies include a preference clause covering energy generated, and further make sure that pumped storage projects bear an equitable share of the cost of the federally-owned projects which make them possible.

(4) NRECA deplored and opposed any plan of investor-owned utilities to build transmission systems "which would control, monopolize, and raise the delivered cost of federal power" in the Upper Colorado River Storage Basin. Instead, it urged Congress to provide appropriations for the federal government to build such lines.

(5) NRECA urged that Congress strike the geographical limitations, fixed in the 1959 amendment, from the Tennessee Valley Authority Act and asked that the TVA power service area be extended to include all systems within economical transmission distance of any TVA generating facility.

HARRISON: Reads Kennedy Message

(6) NRECA requested that Congress get to work on plane for a comprehensive transmission grid spanning much of the US. "It is the desire of the rural electric systems," said NRECA, "that all types of electric system ownership exist in harmony and cooperate in bringing to the United States the most efficient power system in the world, under which the federal government, the investor-owned systems, and the non-profit systems can all be heavily interconnected with each supplying efficient generation to such interconnections and each deriving therefrom its total power requirements."

Congress Is Not Forgotten

Delightful as seemed the prospect of a honeymoon with the Kennedy Administration, NRECA didn't overlook the fact that Congress still holds the purse strings.

Kermit Overby, NRECA legislative representative, sketched in the situation concisely: "Rural electrification and the natural resource cause lost some ground in the November Congressional election. We must see the newcomers in action before we know whether they will help our program."

To offset possible losses, Overby advised the co-ops to set their plans in order and prepare for some energetic lobbying on the Hill.

CLAPP: Usually in Conference

Specifically he urged the co-ops to: **(1)** Decide on which legislation to concentrate, **(2)** Get friends in the Administration to coordinate efforts, **(3)** Urge the Administration to advance the resources program through legislation already on the books, **(4)** Be prepared to spend time and pay expenses to get the job done, **(5)** Be prepared to present their case forcefully to Congress and the public.

As if to remind NRECA members that the cooperatives still have a beachhead in Congress, the convention program included addresses by a parade of lawmakers: Sens Ralph W. Yarborough (D-Tex.), Milton R. Young (R-N. D.), Ernest Gruening (D-Alaska) and Vance Hartke (D-Ind.), and Reps Walter Horan (D-Wash.), Alfred Santangelo (D-N. Y.) and Frank E. Smith (D-Miss.). It was noted that Rep Smith, who had headed one of the Kennedy advisory committees, rated no more than a place on a forum panel discussion, while the other lawmakers spoke before the general sessions of the convention. Smith's district in Mississippi will disappear under the new Congressional redistricting in that state.

Most of the lawmakers recounted their own devotion to rural electrification before the thousands of co-op leaders in the audience. And to a man, they praised the effort and hard work of NRECA General Manager Ellis and the NRECA staff. In this respect, their introductory remarks had the aspect of a testimonial celebration for the co-op organization.

Well up on the NRECA convention program were discussions of public relations efforts of rural electric cooperatives. The co-ops heard criticism of their own public relations image from Earl Hodgson, president of Aubrey, Finlay, Marley & Hodgson. The Hodgson firm conducts the national advertising program for NRECA members who choose to participate.

In disclosing results of a public opinion survey conducted among opinion leaders in widely separated geographical communities, Hodgson said his firm had found that rural electric co-ops have failed to get these people the facts. Furthermore, he said that the opinion-leaders tend to agree with statements that are unfavorable to the cooperatives.

For instance, he said that 38% of the city people questioned believe that rural electric co-ops are owned by the federal government and another 8% of the city people believe the co-ops are owned by stockholders. On the question of whether co-ops pay any taxes, Hodgson said his survey indicated that 45% of the city people and 28% of the small town people belived that co-ops pay no taxes.

The Hodgson survey also indicated that 59% of the respondents to his questions believed that co-op capital needs were financed from federal subsidies. Hodgson further reported that 50% of the people in small towns and 46% of the people disagreed with the federal income tax exemption for co-ops.

To remedy this unfavorable image of cooperatives, Hodgson proposed a $400,000 advertising program with the bulk of the co-op advertising dollars to be placed in *Saturday Evening Post* and *U. S. News & World Report.* A lesser amount would go into *Atlantic Monthly, Harpers, Editor & Publisher,* and other magazines for the publishing trade. In all, Hodgson proposed 40 full-page ads in nine publications. Money for the public relations effort would come from individual co-ops, rather than through NRECA. Local tie-in campaigns would also be provided to participating co-ops.

Dr Norman Mack, Northwestern University sociologist, offered further criticism of the co-ops public relation efforts. His main points:

(1) "Too many of your pamphlets, brochures, and movies strike me like a Gene Autry western, where I always used to find it easier to identify with the villian than with the hero. I think the reason for my reaction is their self-satisfied, as-all-right-thinking-people-know air. . . . They may be reassuring to those who already believe, but they are unlikely to convert the heathen.

(2) "There is a tendency for people in the cooperative movement to applaud the glorious past instead of stressing and an inspiring, exciting future. . . "

(3) "There is a terrific overemphasis on farmers. . . The farmers at which such a message is aimed are a declining race. If the cooperative movement is going to survive and grow, it has to appeal to people in metropolitan areas."

Three Big Problems Are Stated

In his keynote address, Ellis singled out these three problems for prompt attention: **(1)** "Our power sales have increased, but our power supply has become critical." **(2)** "We are serving more consumers, but we are also losing consumers." **(3)** Everywhere, our service areas are being raided by other power distributors.

Ellis called on co-op leaders to "take a giant step" to meet these problems head-on. For the first, he saw some hope in the new Kennedy Administration's promise of more federal power projects and a more liberal attitude toward generation and transmission loans.

On the second, he noted that co-ops now have more than 400,000 idle services along their lines—representing about 8% of the total customers of co-ops over the 25 years of their existence. In some of the hard-hit areas, he said individual co-ops have as many as 20% idle services on their lines. To remedy this, he suggested strong support for legislation designed to redevelop rural areas.

On the third—territorial invasion—he said that the forays were being made by both investor-owned companies and municipalities. As cities extend their corporate limits into the country, the power supplier also reached into the rural areas. Ellis called for state legislation to protect co-op territories and said that a strong moral stand by President Kennedy would be helpful.

Utilities Agree on 345 Kv For Interchange Tie Lines

A 30-year interconnection pact involving transmission of up to 150 Mw over 130 miles of new 345-kv line was recently signed by Indianapolis Power & Light Co and the Indiana & Michigan Electric Co, a member of the American Electric Power System.

Construction of the facilities to affect the interconnection will begin immediately and are tentatively scheduled for completion by May, 1963, the two utilities have announced.

New Substation Involved

Southeast of Indianapolis, Indianapolis Power & Light will construct a new substation of at least 200-Mva capacity, which can receive power at 345 kv.

Indiana & Michigan Electric, for its part, will construct two sections of 345-kv transmission line totaling 138 miles. The two sections form a triangle based on the existing 345-kv Tanners Creek to Muncie transmission line. One new section, emanating from Tanners Creek, runs generally northeast from Indianapolis to DeSoto substation near Muncie. The new 345-kv line, to be built by I&M, will be of "bundle conductor" construction and have a power transmitting capacity approximately twice that of the basic 345-kv line now utilized by the company.

Other provisions of the agreement between the two utilities provide for the interchange of up to 50 Mw of power by either company during periods of emergency and also makes provision for the coordination of scheduled maintenance of generating facilities by both companies.

The agreement will allow IP&L to defer until 1966 the in-service date of next unit to be built following a 100-Mw unit now being completed at Elmer W. Stout Station, which has an in-service date of May, 1961. IP&L has also announced plans to raise from 85 Mw to about 200 Mw the emergency power available for interchange between them and Public Service Co of Indiana through construction of a short stretch of 138-kv line to a new substation that PS of Indiana is building six miles southeast of Indianapolis near Five Points, Ind. The line will run from IP&L's Southeast Substation to Public Service's new substation. Facilities are to be ready by June 1, 1961. This furthers the long-standing agreement between two utilities for emergency power interchange. The existing 85 Mw of power is available through PS of Indiana's Lenore substation southwest of Indianapolis. For additional power, PS of Indiana is building a two-circuit, 230-kv steel tower line from Columbus, Ind., to the Five Points sub. A total of 200-Mw of power will be used for emergencies and to coordinate operation and maintenance schedules of generating equipment.

In another section of the AEP System, the Ohio Power Co has announced that it will build a 54-mile, 345-kv transmission line from Tidd Plant, near Brilliant, Ohio, to the Canton area during the next three years. The project will represent an investment of approximately $6,850,000, it was announced. This amount covers terminal equipment such as transformers and circuit breakers, plus the cost of surveys and rights of way and construction of the line itself.

The proposed Tidd-Canton line will bring the Ohio mileage of 345-kv line on the AEP System to 385 miles.

By the end of this year, Ohio Power expects to spend $750,000 on the new transmission project. Work already completed included surveying the route of the line and acquiring most of the right of way. Actual construction of the line into Canton will start in 1962 and will be completed late in 1963.

Public Power Peace Asked in Nebraska

Consumers Public Power District has called for a cease fire in the conflict among Nebraska public power agencies. In a letter to Governor Frank B. Morrison, members of the State Legislature, and directors of all public power agencies, CPPD President Earl I. Mead asked equitable solutions of the conflicts, confronting the agencies, which "obscure the great benefits to the citizens of the state." Mead solicited support in "setting up the mechanics for defining the service areas and functions of all public power agencies."

The letter attacked legislation presently proposed by the rural cooperatives of the state as "designed to force changes in the public power setup to the benefit of the rurals and without regard to the equities and rights of other districts and the ultimate users of electric service." This legislation would encourage the sale of public power districts' properties to co-ops, and permit them to condemn much of CPPD's property outside the city of Columbus.

As an alternate plan, CPPD proposed that it merge its Eastern System with the Nebraska Public Power System. The merged agency would operate a high-voltage transmission grid system supplying CPPD's customers, municipalities, and the co-ops. If the proposal is approved CPPD would terminate its rural electric service.

Mistake Delays Pumped Storage

Public Service Co of Oklahoma's license application for its 200-Mw Sand Creek pumped-storage power project (EW, Dec. 26, 1960, p 48), to Federal Power Commission, has been set back about a month because of a bureaucratic blooper in Washington.

Official notices of the proposed project—to be printed in local newspapers—accidentally failed to be sent out. This forced the FPC to postpone its deadline for filing of intervenors' petitions from Feb. 14 to Mar. 17. At present, however, no other parties have intervened in the license application.

Public Service hopes to win early approval of its project so that it can award contracts for four 78,000-hp reversible-pump turbines by July 1, and so it can award contracts for four 50-Mw generators by Jan. 1, 1962. Public Service hopes to complete the project by April 1, 1964, so that it can be ready to operate when the federal Keystone Dam—now under construction by the Corps of Engineers—is completed on or before May 1, 1964.

The big, federal Keystone Reservoir, across the Arkansas River upstream from Tulsa, would provide the lower pool, while Public Service proposes to build the upper reservoir on Sand Creek at the edge of Keystone. Since the upper dam is across Sand Creek, a nonnavigable stream, Public Service wouldn't need FPC authority to build it. But public service is seeking FPC approval because the project would use water pumped up from the federal Keystone Reservoir below. The Sand Creek units would use about 7,000 acre-ft of water daily.

Public Service plans to generate power from its Sand Creek station during eight peak hours on weekdays, and plans to pump water back for ten hours, using weekend periods for additional pumping, if necessary.

The project may be licensed by the FPC without a public hearing, if there are no intervenors or no engineering differences between the company and FPC staff. The FPC staff has asked Public Service for more detailed data on proposed soils and core borings in the area, as well as more information on dam and dike design and stability analyses and data on penstocks, tailrace canals, the forebay, junction box, tunnel and shaft designs.

The Sand Creek project would cost an estimated $22.1-million, have an initial and ultimate capacity of 200 Mw. The upper reservoir would require a dam 160 ft high by 5,150 wide, plus an earthen dike of another 5,800 ft. Although the upper dam would be only 160 ft high, the generating head would be about 235 ft because of additional drop between the upper reservoir and the powerhouse on the edge of Keystone Reservoir. The power would be connected by two double-circuit, 138-kv lines: one to Public Service's existing Bartlesville transmission line, the other to the company's Tulsa-Sand Springs line.

New Report on California-Northwest Tie

Stage II of a report on an interconnection between California and the Pacific Northwest has been given to the California Department of Water Resources by H. Zinder & Associates, consultants. Justification for two single-circuit, 500-kv lines from Washington and Oregon to Los Angeles is based on the report's declaration that there is, and will be for 15 years or more, a surplus of from 600 to 2,200 Mw of hydroelectric peaking capacity in the Pacific Northwest.

The report also proposes that it is necessary to find a major market for Bonneville Power Administration power, or for BPA to raise its wholesale rates, to eliminate deficiencies in revenues ($11,591,873 in 1960). California, with ". . . rapidly growing loads and increasing power costs, affords the only immediate major market for Pacific Northwest surplus hydroelectric and thermal electric power," the report states.

Included in the recommendations is use of Northwest coal deposits for additional generation.

Stage II of the Zinder studies goes into greater detail on several factors than the initial report. Among these are:

- The effect of the proposed Columbia River storage projects in Canada;
- Coordinated operation of California's Central Valley project and Pacific Northwest systems;
- Coordination of the Feather River and Southern California Aqueduct projects; and,
- Coordinated operation of Colorado River projects and Pacific Northwest systems.

The report says:

"The interconnection is definitely feasible whether it is built by a federal or non-federal public agency or by a non-profit corporation."

The report points out that of the three largest utilities in California, Los Angeles Department of Water & Power, Southern California Edison Co, and Pacific Gas & Electric Co, only Los Angeles has indicated a positive interest in purchasing power from the Northwest interconnection.

Building Trades Hear Electric Heat Story

"Very worthwhile" was the way attendees summed up the National Coal Policy Conference's first Electric Home Heating Conference held in Washington, D. C., Friday, Feb. 17.

Aimed principally at educating building trades on the advantages, workings, and future of electric heating, the meeting also attracted real estate men, power company representatives, and coal officials.

Over 150 people heard about the future of the home building market and electric heating; insulation; selling electric heating to the housing industry; promotion; application of equipment; and a builder's report on selling electrically heated homes.

"We might argue about the criteria, but at least AEC has taken a position."

The new criteria include these factors which will receive long and hard looks at Germantown before potential reactor sites are approved or disapproved:

- Population density in the area of the site, and uses made of the area—whether industrial, farming or residential;
- Physical characteristics of the site—seismology, meteorology, hydrology, etc.;
- Technical features of the particular reactor, including power levels and extent to which reactor's design incorporates proven engineering standards—or extent to which the design includes unusual features which could bear on safety.

For protection against excessive radiation exposures, the criteria set forth three distance requirements in consideration of the population density factor. Proposed sites must satisfy exclusion area, low population zone and population center distance measurements. These are calculated by a formula which would vary distances with increasing power capacity.

These distances would guarantee that residents on the edge of the exclusion area, in event of a serious accident, "would not, in the first two hours after a fission release, receive a total radiation dose to the whole body in excess of 25 rem (roentgen equivalent man) or a total radiation dose in excess of 300 rem to the thyroid from iodine exposure."

The second distance criterion, a new one, specifies a low population zone with the same dose limits as the exclusion area except that the time of exposure is "the entire period" of passage of "the radioactive cloud." This distance is generally 10-20 times the exclusion distance.

Population center distance means the "distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents." This measure must be at least one and one-third times the distance from the reactor to the outer boundary of the criteria's second distance, the low population zone.

AEC calculations on the basis of theoretical fission product releases to the atmosphere give minimum distances for the three measures for reactors of 10-1500 tMw. They show that all currently operating reactors, and to those under construction—including Enrico Fermi—measure up to the criteria.

Commission officials feel the standards are as "realistic as could be put on paper at this time" and believe the measurable distances could have been a lot tougher.

"At least, they guarantee that people in the immediate neighborhood of an accident will not be cooked and that people in the next zone are at such distributions that they can be quickly evacuated," AEC says.

Commission officials also emphasize that members of the Advisory Committee on Reactor Safeguards assisted in every step in the criteria evolution. There should be, therefore, no likelihood of widely divergent views developing on interpretation of the safety guides between the Commission and the Advisory Committee.

Industry has been slow to react and wants time to scrutinize thoroughly the full meaning of the guides. First impressions are favorable. But there are spokesmen who question the rule that large reactors (1,500 tMw) shall be placed 18 miles from population centers. Such sites, it is warned, may be impossible to find near large load centers. Interested parties have 120 days to express comments for AEC's consideration before final guides are put into effect.

The criteria have stirred opposition.

Union leaders involved in the Enrico Fermi fast breeder case now before the Supreme Court are deploring release of the criteria as "obviously timed" to prove to the Court that the Fermi location is safe and always has been. New Solicitor General Archibald Cox was privately told precisely that.

Cox, in receiving the remarks, is said to have described the Fermi case as the single most important case inherited from the Eisenhower Administration.

Labor is now so concerned over possible "cushioning effects" the criteria could exert on the Fermi case, it threatens to pull out of current legal proceedings.

Says labor: "Under the new site criteria, endless numbers of Fermi-PRDC cases will continue to crop up. We did our part by raising the safety policy issues, and we're seriously thinking of turning the entire matter over to the Kennedy Administration which should by now be aware of its importance."

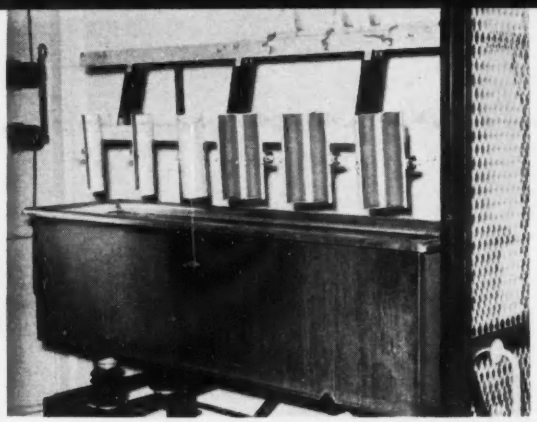
In a separate announcement also bearing on the issue of population proximity, the AEC published an amendment to its regulations raising insurance coverage "for reactors in more highly populated areas" by as much as one-third. The amendment changes from 1-1.5 to 1-2 the range for the location factor, by which the base amount of insurance, $150,000 times the reactor megawatts, is multiplied to compute the financial protection required. The Commission bases its selection of location factor on population of the area around a reactor site and the proximity of that population to the site.

ELECTRIC UTILITY METHODS

E u m

OPERATIONS & TESTING

Jumper Insulation Quickly Tested



SPLIT ALUMINUM TUBES with felt linings clamp around handles on ends of the jumpers to assure good contact

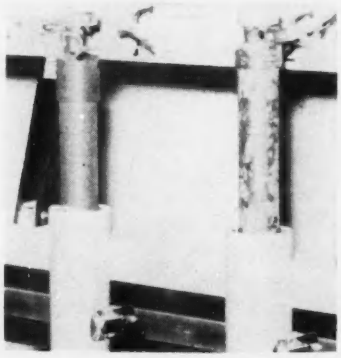
J. L. COOPER, Florida Power & Light Co, Miami, Fla.

A special test head is being used at Florida Power & Light Co to test quickly the insulation integrity of mechanical jumpers, gloves and sleeves. The dielectric strength of mechanical jumpers, as used temporarily on construction and operating jobs, must be tested periodically, just as rubber gloves and other protective equipment are tested. But, due to the special shape and characteristics of jumpers, the application of potential across their insulated section presents a bit of a problem. To provide the dielectric test that is required, and do it in a minimum of time, a special jumper-test head is used.

The test equipment consists of water-filled tanks mounted on insulators, with interchangeable test-heads for mechanical jumpers, gloves and sleeves, positioned above the tank.

With the jumper test-head in position, the fiber sections of the jumpers are clamped in a split, felt-lined aluminum tube. These half-tube assemblies are mounted on an insulated bar across the top of the tank. The conductor is connected to the metering circuit and the bar is lowered so that the tube assemblies and their felt linings are partially immersed—the jumper itself is then immersed in the water of the tank. This assures sure application of potential to the outside surface of the jumper insulation. Several jumpers may be tested at one time, and mounting of the jumpers in test position can be made with a minimum of time and effort.

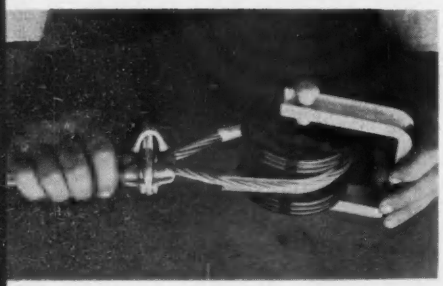
After the jumpers have been readied in the test position, the operator closes the safety gate which lifts the mechanical grounds from the test tank, and closes the interlock circuit, allowing him to apply test voltage.



'SNAP-LOCKS' allow jumpers to be clamped quickly in holders

The ground side of the jumpers may be individually switched through a meter for leakage readings. Since the test panel automatically de-energizes and sounds an alarm when any test failure occurs, this switching allows the operator to determine immediately which jumper has failed.

Thimble Speeds Secondary Dead-Ending



Time required for installing ACSR secondary dead-ends has been reduced by 5 min per job on the Florida Power & Light Co system by using thimbles to protect conductors instead of wrapping them with ribbon.

Suggested by C. N. Waybright, a former lineman and now a foreman at the company's Southwest Yard in Miami, the thimble, which is similar to those used for making up guys, goes around the spool insulator where the conductors are dead-ended. It prevents chafing of aluminum strands where they contact insulators.

Using the thimbles, the dead-ends can be made up on the ground and the completed dead-end can be raised to its place on the pole.

57th ANNUAL STATISTICAL REPORT

Forecast of Utility Budgets—'61-'65

Survey of Planned Capacity Additions

Industry Operating Statistics—1960

PART 2

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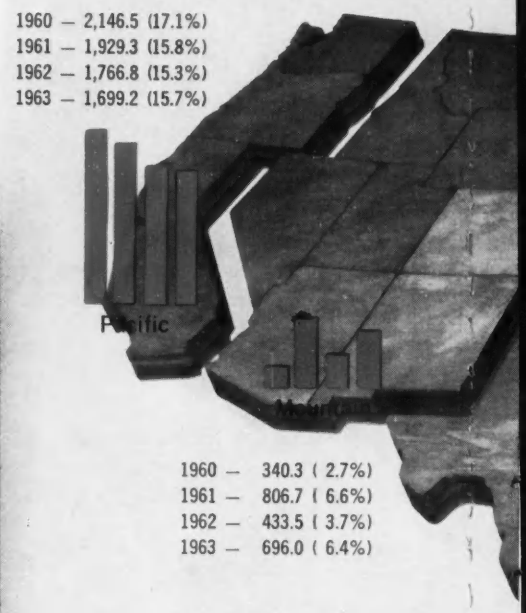
ARTHUR J STEGEMAN
Mgr, Market Research

NEW CAPACITY



Utilities Plan 59,227 Mw Of New Generating Capacity With 34,610 Scheduled For Operation by 1964

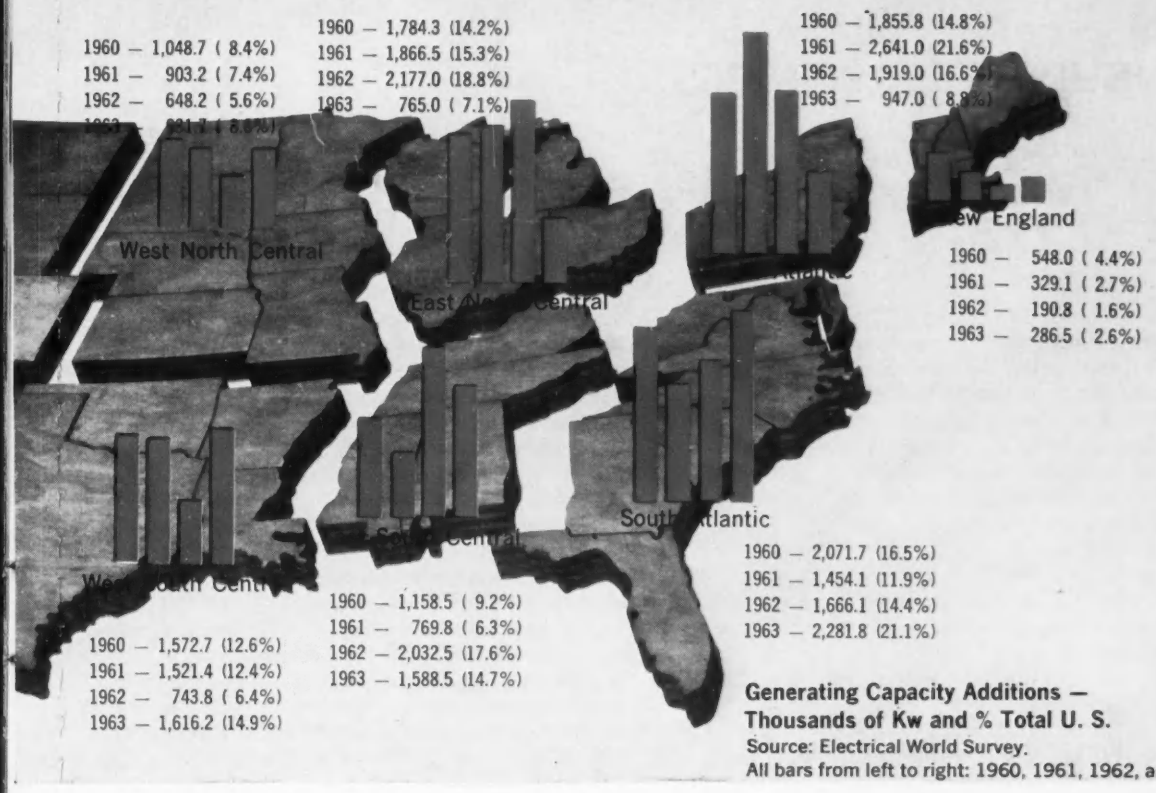
Electric utilities in the contiguous United States plan to add 59,227 Mw to the nation's generating capacity, according to reports received by *Electrical World*. Even though this is short of the 1958 high of 62,804 Mw it tops last year's total of 58,387 Mw and is particularly encouraging in view of the high rate of additions in the late Fifties, which resulted in a more-than-comfortable reserve margin. These new plans seem to indicate an industrywide awareness that a combination of extreme weather and booming industrial activity could easily eat up today's generating reserves.

However, there is a note of caution in this new report on long-range plans. Plans for the next three years (1961-1963) are somewhat less than the comparable period a year ago. These now total 34,610 Mw compared with 35,425 Mw at the beginning of 1960. This means the "after" period, which is now after 1963, is up to 24,616 Mw compared with 22,962 Mw a year ago.

NEW CAPACITY ADDITIONS

	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Hydro						
Power Companies	385,400	373,250	490,100	1,097,500	2,150,200	4,111,050
Municipal, State and Power District Systems	666,432	2,584,400	887,000	446,700	1,947,650	5,865,750
Cooperatives	.....	.....	.....	.....	.....	.....
Federal Agencies	544,000	786,500	543,500	1,112,000	7,276,500	9,718,500
Total	**1,595,832**	**3,744,150**	**1,920,600**	**2,656,200**	**11,374,350**	**19,695,300**
Steam						
Power Companies	9,518,500	7,417,200	7,944,000	5,827,860	11,038,650	32,227,710
Municipal, State and Power District Systems	495,525	806,070	441,500	899,500	1,112,500	3,259,570
Cooperatives	292,000	82,500	13,500	160,000	230,000	486,000
Federal Agencies	475,000	.....	1,190,000	1,190,000	800,000	3,180,000
Total	**10,781,025**	**8,305,770**	**9,589,000**	**8,077,360**	**13,181,150**	**39,153,280**

For a company by company listing of yearly



Generating Capacity Additions — Thousands of Kw and % Total U. S.
Source: Electrical World Survey.
All bars from left to right: 1960, 1961, 1962, and 1963.

Another sign of caution is the drop in three-year plans for steam additions. These plans now total 25,972 Mw for the period 1961 through 1963 compared with the 27,940 Mw reported for the 1960 through 1962 period a year ago. However, cautious optimism again shows up in the "after 1963" figure which now stands at 13,181 Mw compared with 10,243 Mw last year.

Hydro plant additions bulk large in plans for the next three years with a total of 8,321 Mw of capacity planned compared with last year's three-year total of 7,245 Mw. However, "after 1963" is now 11,374 Mw compared with 12,683 Mw a year ago.

Another significant trend shows up in plans for internal combustion additions. This year total IC additions planned stand at 378 Mw compared with 276 Mw in 1960. Additions for the next three years total 317 Mw compared with 240 Mw last year indicating a growing interest in low-investment generating units for peak load service.

REPORTED TO ELECTRIC WORLD—KW†

	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Internal Combustion						
Power Companies	98,260	139,300	53,750	49,520	20,000	262,570
Municipal, State and Power District Systems	49,123	28,560	14,150	26,850	38,710	108,270
Cooperatives	2,272	3,150	.....	2,000	2,000	7,150
Federal Agencies	.....	.....	.....	.....	.....	.....
Total	**149,655**	**171,010**	**67,900**	**78,370**	**60,710**	**377,990**
Total						
Power Companies	10,002,160	7,929,750	8,487,850	6,974,880	13,208,850	36,601,330
Municipal, State and Power District Systems	1,211,080	3,419,030	1,342,650	1,373,050	3,098,860	9,233,590
Cooperatives	294,272	85,650	13,500	162,000	232,000	493,150
Federal Agencies	1,019,000	786,500	1,733,500	2,302,000	8,076,500	12,898,500
Total‡	**12,526,512**	**12,220,930**	**11,577,500**	**10,811,930**	**24,616,210**	**59,226,570**

Source: "Electrical World" Surveys. † Maximum rated capability. ‡ Contiguous U. S.

capacity additions reported to EW see page 92

BUDGETS: 1960-1965

Utilities Estimate Five-Year Expansion Costs

Electric utilities in the contiguous United States plan to spend $24.8 billion for new plant and equipment between now and year-end 1965. This is 8.9% over actual expenditures in the five-year period just passed and is almost identical to the planned total of $24.9 billion reported for the five-year period beginning a year ago. These figures are based on individual utility reports to *Electrical World's* annual survey of electric utility construction and expenditures.

As reported in *Electrical World* on January 23, 1961, expenditures for 1961 are estimated at $4.93 billion—5.1% higher than last year. Next year the industry expects to cut spending 2.6% to $4.8 billion. After that the annual changes are all plus with 1963 up 3.3% to $4.96 billion; 1964 up 0.2% to $4.97 billion; and 1965 up 3.9% to $5.17 billion.

While offering only a slight pickup in annual spending over the next five years, these preliminary estimates are encouraging nevertheless. This observation stems from the fact that from 1962 to 1965 there is a slightly rising trend in industry budgets despite the present economic uncertainty and the fact that long-range budget plans generally tend to follow a declining trend for more distant years. That these do not seems to indicate an industry-wide acceptance of forecasts for a new surge in economic activity about 1964 and 1965 when the products of the post-war baby boom begin to swell household formations.

However, if these economic forecasts come to pass it's more than likely that actual industry spending in these latter years will be somewhat above these preliminary figures and closer to those in *Electrical World's* annual forecast of September 19, 1960 as shown in the accompanying chart and table.

The regions showing the largest percentage increase in spending over the next five years pretty much follow recent geographical shifts in population and industry.

East South Central indicates a five-year total of $2.2 billion, up 27.9% from the 1956 through 1960 period. Next are South Atlantic with $3.7 billion, up 25.9%; West South Central with $2.7 billion, up 25.6%; and Mountain with $1.3 billion, up 25%.

Smaller gains are expected for the following: West North Central, 8.9%; Pacific, 7.0%; New Eng-

Electric Utility Capital Expenditures

	Generation	Transmission	Distribution	Miscellaneous	Total	Industry Forecast
1955	1,548	571	1,343	161	3,623	
1956	1,479	598	1,518	186	3,781	
1957	2,234	747	1,566	199	4,746	
1958	2,582	764	1,373	187	4,906	
1959	2,369	708	1,413	180	4,669	
1960	2,226	715	1,565	183	4,690	
1961‡	2,179	916	1,630	205	4,930	
	Electrical World Forecast — September 19, 1960					
1962	2,189	781	1,778	185	4,933	4,802
1963	2,324	833	1,903	197	5,257	4,960
1964	2,689	926	2,037	220	5,872	4,972
1965	3,160	1,039	2,181	249	6,629	5,167

Source: Electrical World Surveys. 1955-1960 Actual. ‡Prospective.

at $24.8 Billion

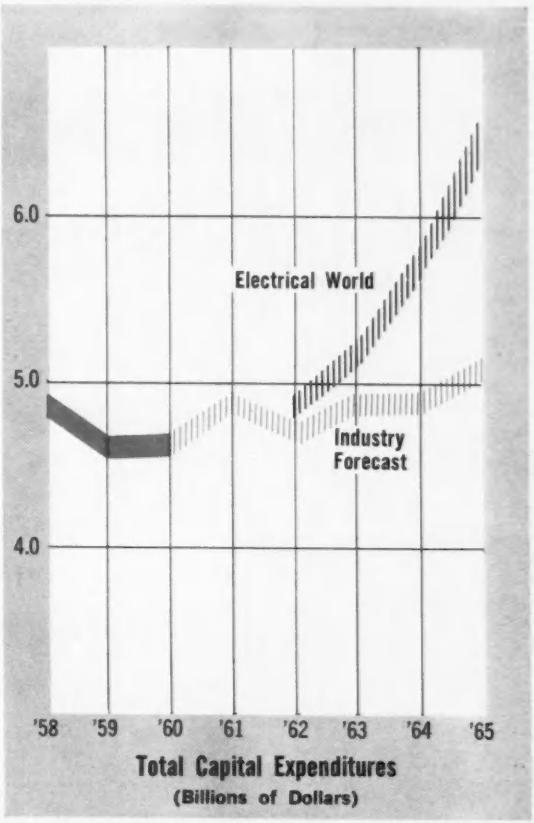
land, 5.2%; and East North Central, 2.8%.

The only downturn is expected in the Middle Atlantic Region, with the five-year total falling 12.9% to slightly less than $4.0 billion.

Nevertheless, the Middle Atlantic will still be one of the top spending regions during this period accounting for 16% of the national five-year total to take second place in order of spending. First place will shift to East North Central with 16.7% of the total.

Next comes South Atlantic with 14.9% of the five-year total followed closely by the Pacific area with 14.8%. Last place again goes to New England with only 4%, just nosing out the Mountain region with 5.1%.

While it's difficult to tell how this money will be apportioned over this entire five-year period many companies provided details of next year's spending plans. These utilities followed the pattern of the larger sample with an indicated cutback of 2.2% in total spending in 1962 with generation, transmission and "miscellaneous" budgets declining 3.3%, 6.7% and 11.3% respectively. However, distribution spending is expected to increase 3.1% to continue the upswing started in '59.



— Millions of Dollars

(By Regions 1960–1965)

	1960†	1961	1962	1963	1964	1965
New England	175	164	184	219	225	205
Middle Atlantic	1,065	939	767	710	743	816
East North Central	712	733	758	761	838	1,057
West North Central	438	419	409	456	446	400
South Atlantic	599	737	670	726	767	807
East South Central	373	466	488	444	462	345
West South Central	450	432	495	673	573	537
Mountain	196	272	270	234	235	265
Pacific	682	768	761	737	683	735
Total United States*	**4,690**	**4,930**	**4,802**	**4,960**	**4,972**	**5,167**

Source: Electrical World's 1960–61 Survey. * Contiguous U. S. † Actual.

SALES (Millions of Kwhr)

	Residential			Rural			Small Light & Power		
	Sales	% Total	% Change	Sales	% Total	% Change	Sales	% Total	% Change
1955	120,524	25.1	11.1%	10,751	2.2	5.7%	76,254	15.8	...
1956	133,851	25.2	11.1%	11,098	2.1	3.2%	82,889	15.6	8.7%
1957	147,059	26.4	9.9%	11,290	2.0	1.7%	90,027	16.1	8.6%
1958	159,047	27.9	8.2%	11,084	1.9	—1.8%	96,016	16.9	6.7%
1959	173,414	27.7	9.0%	12,987	2.1	17.2%	106,697	17.0	11.1%
1960‡	188,100	28.3	8.5%	12,875	1.9	—0.9%	114,100	17.2	6.9%

Source: Edison Electric Institute * Sales on distinct rural rates ‡ Estimated

REVENUE (Millions of Dollars)

	Revenue	% Total	% Change	Revenue	% Total	% Change	Revenue	% Total	% Change
1955	3,186	39.7	9.1%	229	2.9	6.0%	1,909	23.8	.....
1956	3,476	40.0	9.1%	240	2.8	4.8%	2,057	23.6	7.8%
1957	3,760	40.5	8.2%	242	2.6	0.8%	2,207	23.8	7.3%
1958	4,025	41.3	7.0%	251	2.6	3.7%	2,316	23.8	4.9%
1959	4,339	41.0	7.8%	275	2.6	9.6%	2,557	24.2	10.4%
1960‡	4,630	41.2	6.7%	270	2.4	—1.8%	2,720	24.2	6.4%

Source: Edison Electric Institute. * Revenue from sales under distinctly rural rates. ‡ Estimated.

CUSTOMERS (Thousands)

	Customers	% Total	Annual Change	Customers	% Total	Annual Change	Customers	% Total	Annual Change
1955	44,409	84.5	1,269	1,648	3.1	10	6,020	11.5	..
1956	45,710	84.7	1,301	1,687	3.1	39	6,102	11.3	82
1957	46,858	84.9	1,148	1,635	3.0	—52	6,163	11.2	61
1958	47,788	85.0	930	1,634	2.9	— 1	6,256	11.1	93
1959	48,969	85.2	1,181	1,660	2.9	26	6,338	11.0	82
1960‡	49,985	85.4	1,016	1,570	2.7	—90	6,415	11.0	77

Source: Edison Electric Institute * Customers served under distinctly rural rates ‡ Estimated

	Large Light & Power			Other Classifications			Total	
	Sales	% Total	% Change	Sales	% Total	% Change	Sales	% Change
1955	253,711	52.8	...	19,681	4.1	5.0%	480,921	17.0%
1956	281,501	53.1	11.0%	20,789	3.9	5.6%	530,128	10.2%
1957	287,849	51.6	2.3%	21,604	3.9	3.9%	557,829	5.2%
1958	280,220	49.2	— 2.7%	22,794	4.0	5.5%	569,161	2.0%
1959	308,787	49.2	10.2%	24,858	4.0	9.1%	626,743	10.1%
1960‡	322,100	48.4	4.3%	27,750	4.2	11.6%	664,925	6.1%

	Revenue	% Total	% Change	Revenue	% Total	% Change	Revenue	% Change
1955	2,360	29.4	.....	336	4.2	6.0%	8,020	10.2%
1956	2,566	29.5	8.7%	359	4.1	6.8%	8,698	8.5%
1957	2,696	29.0	5.1%	385	4.1	7.2%	9,290	6.8%
1958	2,728	28.0	1.2%	414	4.3	7.5%	9,734	4.8%
1959	2,952	27.9	8.2%	450	4.3	8.7%	10,573	8.6%
1960	3,115	27.8	5.5%	495	4.4	10.0%	11,230	6.2%

	Customers	% Total	Annual Change	Customers	% Total	Annual Change	Customers	Annual Change
1955	311	0.6	..	171	0.3	6	52,559	1,344
1956	319	0.6	8	177	0.3	6	53,995	1,436
1957	332	0.6	13	183	0.3	6	55,171	1,176
1958	341	0.6	9	189	0.3	6	56,208	1,037
1959	343	0.6	2	195	0.3	6	57,505	1,297
1960‡	343	0.6	0	197	0.3	2	58,510	1,005

AVERAGE USE

	Residential				Small Light	
	Average Use		Average Bill		Average Use	
	Kwhr	Change	per Kwhr	Annual	Kwhr	Change
1955.....	2,751	202 (7.9%)	2.64¢	$72.63	12,722	... .
1956.....	2,969	218 (7.9%)	2.60¢	$77.19	13,649	927 (7.3%)
1957.....	3,174	205 (6.9%)	2.56¢	$81.25	14,658	1,009 (7.4%)
1958.....	3,366	192 (6.0%)	2.53¢	$85.16	15,414	756 (5.2%)
1959.....	3,585	219 (6.5%)	2.50¢	$89.63	16,896	1,482 (9.6%)
1960‡.....	3,800	215 (6.0%)	2.47¢	$93.86	17,860	964 (5.7%)

Source: Edison Electric Institute ‡ Estimated

PRODUCTION

SOURCE AND DISPOSAL OF ENERGY—MILLIONS OF KWHR

	Production		Total	Add Net	Energy Used by	Total for		Sales to Ultimate
	Fuel	Hydro	Production	Imports	Producer	Distribution	Losses	Consumers
1955.....	434,063	112,975	547,038	3,310	13,908	536,440	55,519	480,921
1956.....	478,639	122,029	600,668	4,548	16,613	588,603	58,475	530,128
1957.....	501,275	130,232	631,507	3,601	18,293	616,815	58,986	557,829
1958.....	504,836	140,262	645,098	3,319	18,021	630,396	61,235	569,161
1959.....	572,224	137,782	710,006	3,607	22,109	691,504	64,761	626,743
1960*.....	607,349	145,512	752,861	4,518	25,304	732,075	67,150	664,925

Source: Federal Power Commission and Edison Electric Institute. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad classification. * Estimated.

INSTALLED CAPACITY

INSTALLED CAPACITY BY TYPE OF PRIME MOVER—MW

	Fuel			Hydro			Total	
	Capacity	% Total	Annual Change	Capacity	% Total	Annual Change	Capacity	Annual Change
1955.....	89,468	78.2	10,086	25,004	21.8	1,793	114,472	11,880 (11.6%)
1956.....	95,043	78.7	5,575	25,654	21.3	650	120,697	6,225 (5.4%)
1957.....	102,087	79.1	7,044	27,036	20.9	1,382	129,123	8,426 (7.0%)
1958.....	113,237	79.4	11,150	29,359	20.6	2,323	142,596	13,473 (10.4%)
1959.....	125,767	80.2	12,530	31,074	19.8	1,715	156,841	14,245 (11.0%)
1960*.....	135,104	80.7	9,337	32,373	19.3	1,299	167,477	10,636 (10.7%)

Source: Federal Power Commission. * Preliminary.

and Power		Total Ultimate Customers				
Average Bill		Average Use		Average Bill		
per Kwhr	Annual	Kwhr	Change	per Kwhr	Annual	
2.50¢	$318	9,265	1,138 (14.0%)	1.67¢	$154.73	1955
2.48¢	$338	9,944	679 (7.3%)	1.64¢	$163.08	1956
2.45¢	$359	10,214	270 (2.7%)	1.67¢	$170.57	1957
2.41¢	$371	10,227	13 (0.1%)	1.71¢	$174.88	1958
2.40¢	$406	11,020	793 (7.8%)	1.69¢	$186.24	1959
2.38¢	$425	11,460	440 (4.0%)	1.69¢	$193.67	.....‡1960

PRODUCTION OF ELECTRIC ENERGY BY OWNERSHIP—MILLIONS OF KWHR

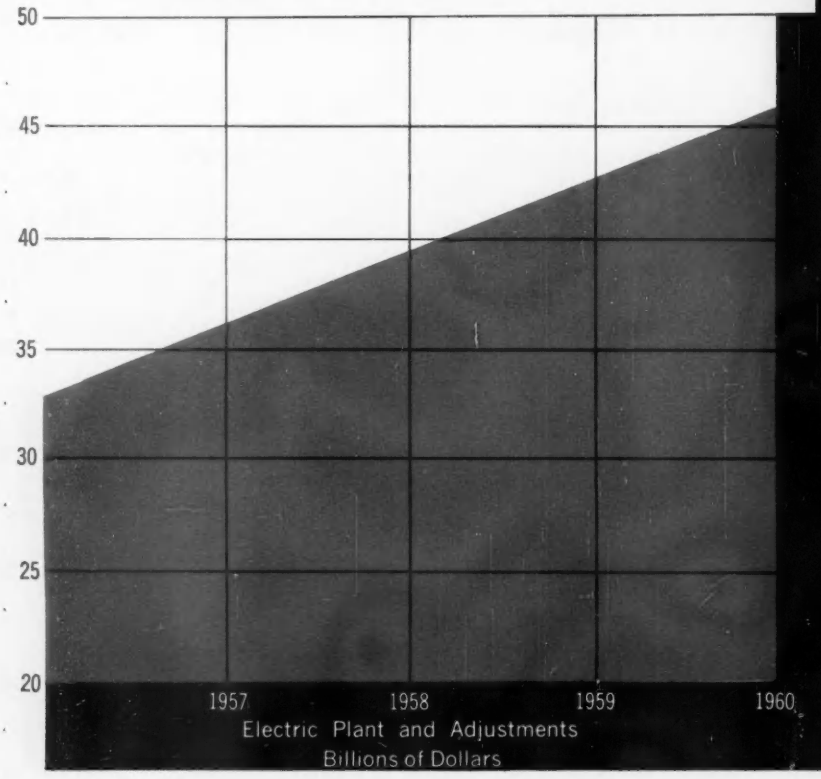
	Power Companies		Federal Agencies		Municipal, State & Power District Systems		Cooperatives	
	Production	% Total	Production	% Total	Production	% Total	Production	% Total
1955.....	420,869	76.9	89,064	16.3	34,061	6.2	3,044	0.6
1956.....	459,015	76.4	100,711	16.8	37,529	6.2	3,413	0.6
1957.....	480,943	76.2	109,176	17.3	38,358	6.1	3,030	0.5
1958.....	490,402	76.0	110,437	17.1	40,837	6.3	3.422	0.5
1959.....	544,234	76.6	109,052	15.4	52,316	7.4	4,404	0.6
1960*.....	578,360	76.8	112,305	14.9	56,566	7.5	5,630‡	0.8

Source: Federal Power Commission. * Preliminary. ‡ Estimated by Electrical World.

GENERATING CAPACITY BY OWNERSHIP—MW

	Power Companies		Federal		Municipal, State & Power District Systems		Cooperatives	
	Capacity	% Total	Capacity	% Total	Capacity	% Total	Capacity	% Total
1955.....	86,887	75.9	16,962	14.8	9,823	8.6	800	0.7
1956.....	91,145	75.5	18,336	15.2	10,421	8.6	795	0.7
1957.....	97,376	75.4	19,649	15.2	11,177	8.7	920	0.7
1958.....	108,202	75.9	20,436	14.3	12,982	9.1	977	0.7
1959.....	118,999	75.9	21,874	13.9	14,856	9.5	1,112	0.7
1960*.....	128,000	76.4	22,351	13.4	15,719	9.4	1,407‡	0.8

Source: Federal Power Commission. * Preliminary. ‡ Estimated by Electrical World.



Composite Year-End

Class A and B Electric Utility Companies

Assets
- Electric Plant and Adjustments
- Other Utility Plant and Adjustments
- Total Utility Plant
- Reserves for Depreciation and Amortization of Utility Plant
- Total Utility Plant Less Reserves
- Investment and Fund Accounts
- Current and Accrued Assets
- Deferred Debits
- Capital Stock Discount and Expenses
- Reacquired Securities
- **Total Assets**

Liabilities
- Capital Stock
  - Preferred
  - Common
  - Premium on Capital Stock
  - Total Capital Stock
- Long Term Debt
  - Bonds
  - Other
  - Total Long Term Debt
- Current and Accrued Liabilities
- Reserves (except those deducted above)
- Deferred Credits
- Contributions in Aid of Construction
- Accumulated Deferred Taxes on Income
- Surplus
  - Earned
  - Capital
  - Total Surplus
  - **Total Liabilities**

Balance Sheet Ratios
- Reserve for Depreciation Percent of Utility Plant
- Current Assets Times Current Liabilities
- Long Term Debt
  - Percent of Gross Utility Plant
  - Percent of Net Utility Plant

1960 estimated by "Electrical World"

Revenue, Expenses, and Net Income

The investor-owned electric companies continued to make new highs during 1960 in the preliminary financial statistics just released.

Some of the more important ones were:

- Electric revenues totaled $9.7 billion.
- Operating ratio (fuel, salaries, maintenance, and other operating expenses) hit a low point of 42.1%.
- Depreciation charges went over the $1 billion mark for the first time. It amounted to $1.04 billion.
- Taxes still continued on the upside, going to $2.4 billion.
- Net income increased to $1.7 billion.
- Amount transferred to surplus was $475 million.

The growth of electric revenues for the investor-owned electric companies increased 6.1% in 1960, reaching $9.7 billion. This accounted for 84% of the estimated $11.5 billion of revenues reported for the entire industry by the Edison Electric Institute.

Operating expenses also went to a record high and were up 3.9% over the previous year. Fuel expenses continued downward which had begun in 1957 when they amounted to 17.1¢ of every revenue dollar. The decrease was largely due to cheaper coal prices and increased efficiencies in generating units. Salaries and wages paid to about 340,000 employees of investor-owned electric companies hit a low point of 16.5¢ of every revenue dollar, while taxes continued to take the largest part (24.3¢). This latter figure is compared with 3.5¢ out of every dollar that a customer of a government-owned and/or financed power agencies pay.

The operating ratio (fuel, salaries and wages, maintenance and other operating expenses but exclusive of taxes) continued to decline which shows that the expense items over which management has good control are taking less of a bite of the total as time goes on.

With new plant and equipment being added at such a high rate, depreciation charges continue to increase and amounted to $1.04 billion last year.

Capital charges totaled $695 million with the increase coming largely from the sale of $1.4 billion in bonds and debentures.

The investor-owned electric companies were able to carry down $475 million to the surplus account

(*Continued on page* 84)

Balance Sheet (Millions of Dollars)

1960*	1959	1958	1957	1956
45,500	42,322	39,264	35,998	32,762
4,800	4,531	4,221	3,993	3,684
50,300	46,853	43,485	39,991	36,446
9,800	8,978	8,203	7,570	6,962
40,500	37,875	35,282	32,421	29,484
1,050	1,058	1,008	979	937
3,200	2,943	2,772	2,799	2,617
250	230	215	202	203
85	81	78	74	70
30	25	29	23	29
45,115	**42,212**	**39,384**	**36,498**	**33,340**
4,300	4,115	4,023	3,774	3,686
8,600	8,520	8,050	7,660	7,248
1,700	1,465	1,213	1,053	943
14,600	14,100	13,286	12,487	11,877
20,700	19,296	18,113	16,586	14,770
580	538	466	465	460
21,280	19,834	18,579	17,051	15,230
3,225	2,966	2,781	2,804	2,627
125	107	101	99	104
175	167	167	155	154
200	170	151	137	122
1,400	1,157	920	695	483
3,750	3,356	3,042	2,718	2,414
360	355	357	352	329
4,110	3,711	3,399	3,070	2,743
45,115	**42,212**	**39,384**	**36,498**	**33,340**
19.5	19.2	18.9	18.9	19.1
1.0	1.0	1.0	1.0	1.0
42.3	42.3	42.7	42.6	41.8
52.5	52.4	52.7	52.6	51.7

Source: Federal Power Commission.

Nearly 40% of the total electric plant of Class A and B electric utility companies in use on Dec. 31, 1960 had been added since the end of 1956. With approximately 340,000 employees in the business, the investment in each worker amounted to more than $133,000 at the end of last year. Since the end of 1956, long-term mortgage bonds increased around $6 billion while outstanding common stock in these companies rose only about $1.4 billion.

Mounted to New Peaks in 1960

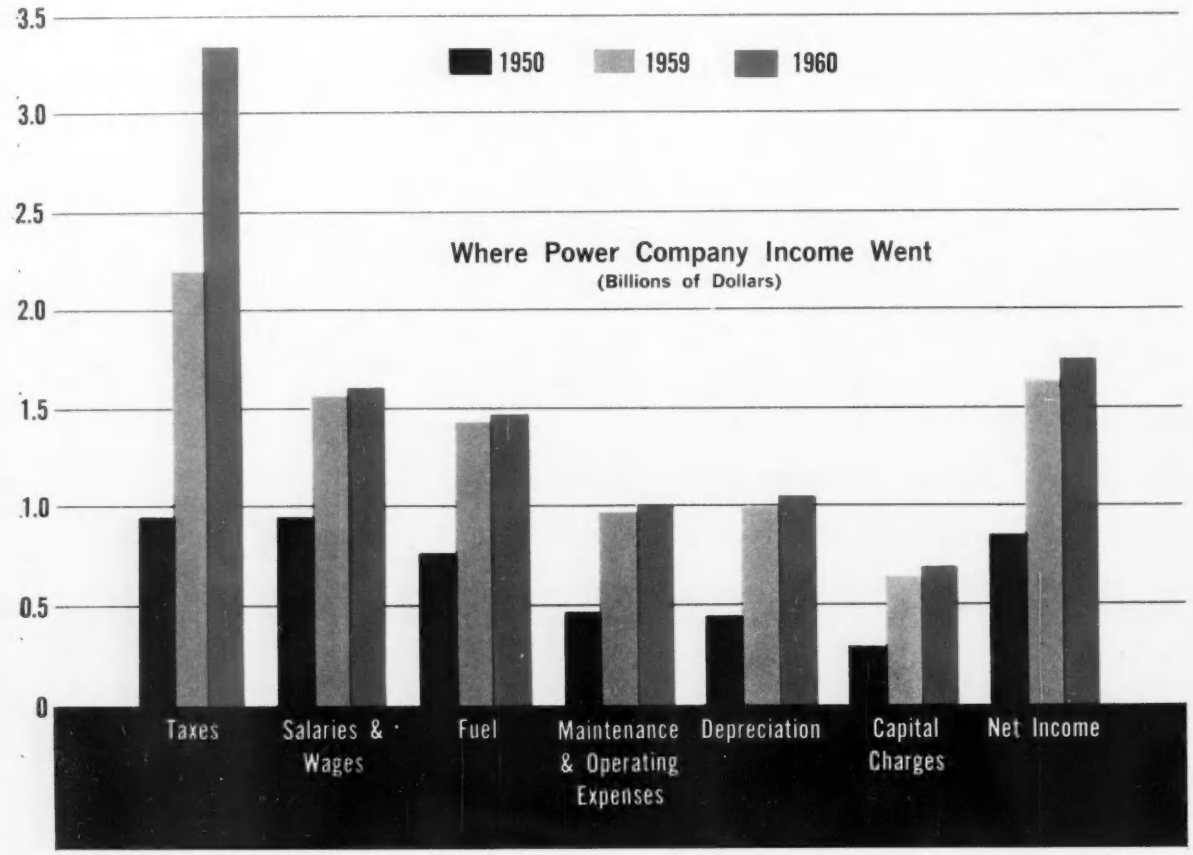
SECURITY SALES BY ELECTRIC COMPANIES

(Thousands of Dollars)

	Bonds, Debentures, etc.		Stocks,		Distribution of Security Sales		
	Public Investors	Institutional Investors	Common and Preferred	Total Financing	New Capital	Refunding	Total Issues
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,223	1,361,922
1946	633,966	64,040	384,441	1,082,447	172,846	909,601	1,082,447
1947	1,039,517	153,159	384,699	1,577,375	567,729	1,009,646	1,577,375
1948	996,641	156,525	297,460	1,450,626	1,314,456	136,170	1,450,626
1949	959,978	192,280	640,953	1,793,211	1,444,826	348,385	1,793,211
1950	838,108	278,389	591,340	1,707,837	1,300,040	407,797	1,707,837
1951	778,308	110,696	552,943	1,441,947	1,432,257	9,690	1,441,947
1952	929,167	145,860	630,652	1,705,679	1,693,514	12,165	1,705,679
1953	973,075	217,022	766,594	1,956,691	1,938,815	17,876	1,956,691
1954	1,379,885	184,063	784,469	2,348,417	1,761,154	587,263	2,348,417
1955	871,173	130,298	538,927	1,540,398	1,409,415	130,983	1,540,398
1956	911,145	54,616	518,227	1,483,988	1,479,987	4,001	1,483,988
1957	1,687,820	338,667	553,344	2,579,831	2,559,234	20,597	2,579,831
1958	1,701,683	65,393	554,081	2,321,157	2,209,219	111,938	2,321,157
1959	1,178,820	84,150	641,596	1,904,566	1,904,566	.....	1,904,566
1960	1,352,202	89,600	309,245	1,751,047	1,751,047	.....	1,751,047

Source: Irving Trust Co.

INVESTOR OWNED COMPANIES ACCOUNT FOR 84% OF INDUSTRY REVENUES



which, along with the sale of around $1.8 billion in new financing, and the balance in depreciation and bank loans, they were able to meet the $3.5 billion construction program in 1960.

Rate increases granted during the year totaled $48 million from 20 requests. The largest increase was received by Consolidated Edison Co of New York, and was an interim one. The company requested a second immediate interim boost at the closing session of the Public Service Commission's hearings, pending the final determination by PSC. The requested amounts pending by the industry before the various state commissions have been falling off, going from $100 million in the peak year of 1958 to $71 million at the end of 1960. The fall off in recent years is probably due to greater use of the "flow-through" method due to federal tax savings.

Financing by the investor-owned electric utilities as prepared by the Irving Trust Co showed that these companies sold $1.8 billion of securities during 1960. It consisted of all new capital and no refunding was done. Preferred stock financing totaled $158 million of which nearly $4 million was offered to stockholders. Common stock sold to the public amounted to only $108 million of which $30.5 million was offered to the stockholders through rights.

POWER COMPANIES INCOME STATEMENT

(Millions of Dollars)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Total Electric Revenue	4,510	5,005	5,426	5,940	6,317	6,934	7,521	8,054	8,478	9,144	9,700
Operating Expenses	2,158	2,400	2,577	2,801	2,880	3,076	3,353	3,635	3,713	3,925	4,080
Depreciation	438	475	513	565	634	705	776	835	914	944	1,040
Total Expenses	2,596	2,875	3,090	3,366	3,514	3,781	4,129	4,470	4,627	4,919	5,120
Electric Operating Income before Taxes	1,914	2,130	2,336	2,574	2,803	3,153	3,392	3,584	3,851	4,225	4,580
Taxes	948	1,150	1,224	1,339	1,442	1,641	1,766	1,858	1,980	2,192	2,350
Electric Operating Income after Taxes	966	980	1,112	1,235	1,361	1,512	1,626	1,726	1,871	2,033	2,230
Other Income [1]	147	154	166	149	181	188	201	210	194	210	200
Gross Corporate Income	1,113	1,134	1,278	1,384	1,542	1,700	1,827	1,936	2,065	2,243	2,430
Capital Charges [2]	282	311	322	343	396	443	481	509	550	617	695
Net Income	831	823	956	1,041	1,146	1,257	1,346	1,427	1,515	1,626	1,735
Dividends	625	658	732	788	876	952	1,032	1,080	1,117	1,189	1,260
Surplus	206	165	224	253	270	305	314	347	398	437	475

Source: Federal Power Commission and Edison Electric Institute for the figures shown from 1950 to and including 1957; Edison Electric Institute for the actual figures for 1958 and 1959, and Edison Electric Institute and Electrical World for estimated 1960. [1] Includes revenues of gas, water, and steam departments and interest on securities held. [2] Includes amortization, interest on long term debt, etc.

DISTRIBUTION OF THE ELECTRIC REVENUE DOLLAR

(Percent)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Fuel	16.8	17.2	16.9	17.1	15.7	15.9	16.1	17.1	15.8	15.6	15.3
Salaries and Wages	20.7	20.5	20.0	19.6	19.4	18.1	17.9	17.7	17.6	16.8	16.5
Maintenance and Other Operating Expenses	10.4	10.2	10.5	10.5	10.5	10.3	10.6	10.3	10.4	10.5	10.3
Operating Ratio	47.9	47.9	47.4	47.2	45.6	44.3	44.6	45.1	43.8	42.9	42.1
Depreciation	9.7	9.5	9.5	9.5	10.0	10.2	10.3	10.4	10.8	0.9	10.7
Taxes	21.0	23.0	22.6	22.5	22.8	23.7	23.5	23.1	23.4	24.0	24.3
Electric Operating Income Before Taxes	42.4	42.6	43.1	43.3	44.4	45.5	45.1	44.5	45.4	46.2	47.2
Electric Operating Income After Taxes	21.4	19.6	20.5	20.8	21.6	21.8	21.6	21.4	22.0	22.2	22.9

Source: Federal Power Commission and Edison Electric Institute for the figures shown from 1950 to and including 1957. Edison Electric Institute for the actual figures for 1958 and 1959, and Edison Electric Institute and Electrical World for estimated 1960.

ELECTRIC RATE INCREASES

	GRANTED			PENDING	
	Number	Dollars	As of Dec. 31	Number of Applications	Dollars
1951	27	32,900,000	1951	32	75,700,000
1952	46	76,700,000	1952	21	44,400,000
1953	27	21,000,000	1953	22	62,700,000
1954	21	54,200,000	1954	16	37,600,000
1955	19	25,500,000	1955	8	10,500,000
1956	7	6,700,000	1956	11	35,100,000
1957	13	58,500,000	1957	20	68,000,000
1958	22	76,000,000	1958	31	100,300,000
1959	28	54,800,000	1959	26	92,000,000
1960*	20	48,100,000	1960*	16	71,305,000

* Preliminary.

ELECTRICAL MANUFACTURING

Sales of Electrical Products

Electrical manufacturers boosted shipments 5.1% to $22.6 billion during 1960 but only because sales of industrial electronics and communications equipment jumped 20% to $7.0 billion and accounted for roughly one-third of total industry shipments. Otherwise, sales gains in 1960 were rather anemic and, according to NEMA's latest forecast, the same can be expected in 1961 with total industry shipments up a meager 0.8% to $22.8 billion.

Other gainers in 1960 were: Industrial equipment,

The definitions of electric products included in the following groups have been changed as of December 1959. Therefore, data previously released are not comparable cautions the National Electrical Manufacturers Association. However, the following data for 1958, 1959, 1960 and 1961, are comparable.

Non-Electrical Products (including non-electrical defense and war material) manufactured within the industry have been excluded from these data.

Note: Products in italics are additions to the eight product groupings previously used.

Total Shipments of Electrical Products ($ Millions)

1958	$19,352.0
1959	$21,522.9
1960*	$22,622.3
1961†	$22,795.5

* Preliminary † NEMA Forecast

Data shown in tabulation are based upon total industry shipments including exports and interplant transfers of electrical products which are considered to cover not only those products included in the Electrical Machinery Group, as defined by the US Census of Manufacturers, but also lighting fixtures, steam engines and turbines, household and commercial refrigeration machinery, air conditioning machinery, household laundry equipment, vacuum cleaners and electrical insulating materials such as porcelain, mica, laminated products, vulcanized fibre, varnished fabric and paper.

Consumer Products ($ Millions)

1958	$5,406.1
1959	$5,959.4
1960	$5,661.4
1961	$5,803.0

This includes electric household refrigerators, electric farm and home freezers, electric ranges, electric water heaters, electric housewares, electric fans, electric commercial cooking equipment, electric dehumidifiers, electric household food waste disposers, and dishwashers, packaged room air conditioners, electric dryers, electric ironers, electric washing machines, vacuum cleaners, radio and television receiving sets, *house heating equipment, phonograph records and needles, radio receiving tubes, commercial air conditioning and commercial refrigeration,* compressors and condensing units and parts and accessories for electrical appliances.

Lighting Equipment ($ Millions)

1958	$1,313.7
1959	$1,472.6
1960	$1,516.8
1961	$1,516.8

This includes industrial, commercial and residential lighting equipment, aviation ground lighting, floodlighting and street lighting equipment, vehicular, railway and other lighting equipment, portable lamps, *ballasts, electric lamps and lamp components.*

Industrial Electronics and Communications Equipment ($ Millions)

1958	$5,266.0
1959	$5,849.3
1960	$7,019.2
1961	$7,194.7

This includes *telephone equipment, signalling apparatus, X-Ray apparatus and tubes, power rectifier equipment, power semi-conductor components, other rectifying apparatus, electrical indicating instruments, electron tubes and parts, cathode ray tubes, batteries, induction and dielectric heating apparatus, electrical hearing aids, commercial radio and TV communications, radio and electronic navigation aids etc., electronic type components for communications and industrial electronic controls, recorders, amplifiers, audio equipment etc., electric railway signals and attachments.*

Hit $22.6 Billion, Topping '59 by 5.1%

up 5.0% to $3.6 billion; generation, transmission and distribution equipment, up 3.0% to $2.2 billion; lighting equipment, up 3.0% to $1.5 billion; and building equipment, up 3.0% to $789 million. Insulating material shipments held even at $411 million—still 29.5% ahead of 1958.

Sales declines were registered by the important consumer products group with a drop of 5.0% to $5.7 billion and by insulated wire and cable with an equal drop of 5.0% to $1.4 billion.

Industrial Equipment ($ Millions)

1958	$3,006.8
1959	$3,443.6
1960	$3,615.7
1961	$3,543.4

This includes carbon products, commutators, welding wire, welding machines, resistance welders, industrial heating units and devices, industrial controls, mining belt conveyors, motors and generators, *large generating and converting apparatus*, mining and industrial electric locomotives, renewal parts, manufactured graphite, precision snap-acting switches, *electrical contacts, industrial automatic systems, automatic temperature controls, adsorption, time switches, land transportation and motor controls.*

Building Equipment ($ Millions)

1958	$688.0
1959	$765.7
1960	$788.7
1961	$772.9

This includes conduit fittings, metallic and plastic, outlet and switch boxes, rigid steel conduit and electrical metallic tubing and fittings, wiring devices, molded case breakers, busways, fuses, switch and enclosed breakers, panelboards and distribution boards, bituminous conduit, and *steel underfloor raceways.*

Insulating Materials ($ Millions)

1958	$316.9
1959	$410.5
1960	$410.5
1961	$431.0

This includes steatite electrical products, laminated products, manufactured electrical mica, varnished fabric and paper, varnished tubing and saturated sleeving, and vulcanized fibre, electrical glass insulation, and combed flexible electrical insulation.

Insulated Wire and Cable ($ Millions)

1958	$1,307.5
1959	$1,505.9
1960	$1,430.6
1961	$1,430.6

This includes armored cable, rubber and thermoplastic power and control cable, high temperature insulated wire, flexible cords and cord sets, fixtures and appliance wire, magnet wire, paper power cable, building wire and cable, portable molded rubber sheathed cord and cable, varnished cambric cable, weatherproof and slow-burning wire, communication and signal wire and cable, automotive, aircraft and marine wire and cable, and non-metallic sheathed cable.

Generation, Transmission, and Distribution Equipment ($ Millions)

1958	$2,047.0
1959	$2,115.9
1960	$2,179.4
1961	$2,103.1

This includes power and specialty capacitors, electric measuring and test equipment, transmission and distribution voltage regulators, hydraulic turbines, high voltage insulators, lightning protective devices, dry process electrical porcelain, overhead trolley line materials, switchgear, power and distribution transformers, steam and gas turbines, pole line hardware, rail bonds, transmission hardware, and other related products.

REA-FINANCED SYSTEMS

Co-op Kwhr Sales Jump 9.5% to Up Revenue 7.8%

REA-financed power systems continued to boost sales faster than the industry during 1960. At 27.5 billion kwhr for the year, REA sales were 9.5% ahead of 1959. This served to boost operating revenues 7.8% to $666 million.

Cost of input energy for 1960 held at 1959's 6.7 mills per kwhr while revenue per kwhr declined from 2.06¢ in 1959 to 2.02¢.

Average revenue from REA residential customers (including farm and non-farm) dropped to 2.49¢ in 1960 — a decline of 3.1% from 1959's 2.57¢. Aiding this decline was a further increase of 312 kwhr in average annual residential use raising the REA average to 4,320 kwhr per year compared with 4,008 kwhr in 1959.

The combination of greater usage and lower average rate served to boost the REA residential customers average annual bill from $102.96 in 1959 to $107.40 in 1960.

Statistics of REA-Financed Systems

	1958	1959	1960[1]
CUMULATIVE YEAR-END DATA			
Total Loans Approved	$3,846,620,615	$4,010,696,418	$4,256,347,751
Distribution Lines	2,938,385,204	3,058,674,406	3,193,402,106
Generation and Transmission	868,542,478	910,326,377	1,020,457,273
Consumer Facilities	39,692,933	41,695,635	42,488,372
Funds Advanced	3,254,776,704	3,469,649,317	3,679,662,094
Systems in Operation	1,030	1,032	1,037
Miles of Line in Operation	1,424,441	1,445,835	1,465,000
Consumers Served	4,596,270	4,721,630	4,826,000
Systems Generating Power During Year	76	75	75
Generating Plants—Kw Capacity (Active Only)	1,098,418	1,257,645	1,545,000
ANNUAL DATA			
Energy Generated—Kwhr	3,482,173,000	4,463,821,000	4,740,000,000
Energy Purchased—Kwhr[2]	21,500,345,000	24,033,340,000	26,370,000,000
Total System Input—Kwhr[2]	24,982,518,000	28,497,161,000	31,110,000,000
Energy Sold—Kwhr[2]	21,901,769,000	25,070,622,000	27,450,000,000
Operating Revenues[3]	$563,204,367	$617,730,445	$665,900,000
Operating Deductions Total	450,522,702	493,819,090	539,200,000
Cost of Power[4]	202,692,968	226,294,923	244,700,000
Distribution Expenses—Operations	39,734,778	42,397,330	47,000,000
Distribution Expenses—Maintenance	19,598,409	20,928,992	23,800,000
Consumers Accounting & Collecting	19,231,124	20,668,190	22,200,000
Admin. & General Expenses	47,851,853	53,001,123	58,700,000
Electric Sales Promotion Expenses	8,770,156	10,001,850	11,300,000
Depreciation	94,529,624	100,527,311	108,600,000
Amortization of Intangibles	1,457,800	1,228,295	1,300,000
Taxes	16,655,990	18,771,076	21,600,000
Utility Operating Margin	112,681,665	123,911,355	126,700,000
Non-Operating Margin	9,580,454	11,444,979	13,300,000
Interest on Long Term Debt	46,814,538	48,702,279	51,100,000
Interest Charged to Construction Cr	354,939	806,897	700,000
Other Deductions	581,980	660,279	800,000
Net Margin	75,220,540	86,800,673	88,800,000
PAYMENTS TO GOVERNMENT—CUMULATIVE DATA			
Interest Due	$350,287,796	$397,075,923	$448,151,081
Interest Paid	350,163,823	397,017,809	448,077,489
Principal Due	582,725,559	666,233,373	758,189,241
Principal Paid[5]	725,414,255	823,244,488	924,198,176
Overdue Amounts—More than 30 days	137,553	97,582	102,804
a. Interest	33,336	27,795	24,858
b. Principal	104,217	69,787	77,946
Advance Payments[5]	138,972,625	154,020,026	164,771,227

Source: Monthly Operating Reports of Rural Electrification Administration borrowers and records of Rural Electrification Administration.

[1] Operating and financial statistics of borrowers are based on nine months actual data.

[2] Excludes energy sales between REA borrowers.

[3] Includes revenues from sales of power between REA borrowers.

[4] Cost of power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.

[5] Advance payments are included in Principal Paid.

STATION ECONOMICS

PRODUCTION, CAPACITY, AVERAGE USE

	Production Millions of Kwhr			Year End Capacity Thousands of Kw			Kwhr per Kw of Average Capacity		
	Fuel	Hydro	Total	Fuel	Hydro	Total	Fuel	Hydro	Total
1948	200,228	82,470	282,698	40,908	15,652	56,560	5,052	5,386	5,193
1949	201,352	89,748	291,100	46,446	16,654	63,100	4,610	5,561	4,865
1950	233,203	95,938	329,141	51,244	17,675	68,919	4,774	5,589	4,986
1951	270,922	99,751	370,673	56,907	18,868	75,775	5,010	5,460	5,123
1952	294,121	105,103	399,224	61,807	20,419	82,226	4,955	5,350	5,054
1953	337,432	105,233	442,665	69,457	22,045	91,502	5,141	4,957	5,096
1954	364,617	107,069	471,686	79,381	23,211	102,592	4,899	4,732	4,860
1955	434,063	112,975	547,038	89,468	25,004	114,472	5,141	4,686	5,040
1956	478,639	122,029	600,668	95,043	25,654	120,697	5,188	4,818	5,108
1957	501,275	130,232	631,507	102,087	27,036	129,123	5,086	4,943	5,056
1958	504,836	140,262	645,098	113,237	29,359	142,596	4,689	4,974	4,748
1959	572,224	137,781	710,005	125,767	31,074	156,841	4,788	4,560	4,742
1960*	607,348	145,513	752,861	135,104	32,373	167,477	4,656	4,587	4,643

Source: Federal Power Commission. * Preliminary. 1948 and after excludes former Mining and Manufacturing and Railroad and Railway classification

Coal Rate Slips to 0.88 lb. Per Kwhr

More efficient fuel-fired generating units forced the coal rate down to 0.88 lbs per kwhr in 1960 from 0.89 lbs per kwhr in '59.

These same plants produced 607 billion kwhr in 1960 compared with 572 billion kwhr the year before. Coal was used to produce 403 billion kwhr or 66% of the total to boost coal consumption 4.8% to 176 million tons.

Oil-produced energy declined to 46 billion kwhr from 46.8 billion kwhr in 1959 with a 3.5% drop in oil use to 85.2 million bbl.

Gas use continued to gain this past year by accounting for 158 billion kwhr of thermally-produced energy for a jump of 7.5% over 1959. This boosted gas consumption 5.8% to 1,724 billion cu ft.

Use of hydro generating capacity increased from 4,560 hours in 1959 to 4,587 hours in 1960 while fuel plant utilization skidded from 4,788 hours to 4,656 hours.

CONSUMPTION OF COAL, OIL AND GAS

	Energy Generated From Coal, Oil, and Gas				Coal, Oil, and Gas Consumed				Coal Rate
	Coal Billions of Kwhr	Oil Billions of Kwhr	Gas Billions of Kwhr	Total Billions of Kwhr	Coal Millions of Tons	Oil Millions of Bbl	Gas Billions of Cu Ft	Coal and Equivalent of Oil and Gas Millions of Tons	Pounds per Kwhr
1948	152.9	16.8	30.1	199.8	99.59	42.64	478.10	130.12	1.30
1949	135.5	28.5	37.0	201.0	83.96	66.30	550.12	124.57	1.24
1950	154.5	33.7	44.6	232.8	91.87	75.42	628.92	138.42	1.19
1951	185.2	28.7	56.6	270.5	105.77	63.94	763.90	154.50	1.14
1952	195.4	29.7	68.5	293.6	107.07	67.22	910.12	160.87	1.10
1953	218.9	38.4	79.8	337.1	115.90	82.24	1,034.27	178.49	1.06
1954	239.1	31.5	93.7	364.3	118.38	66.74	1,165.50	180.37	0.99
1955	301.4	37.1	95.3	433.8	143.76	75.27	1,153.28	206.93	0.95
1956	338.5	36.0	104.0	478.5	158.28	72.71	1,239.31	223.73	0.94
1957	346.4	40.5	114.2	501.1	160.77	79.69	1,336.14	232.58	0.93
1958	344.4	40.4	119.8	504.6	155.72	77.67	1,372.85	228.14	0.90
1959	378.4	46.8	146.6	571.8	168.42	88.26	1,628.51	254.53	0.89
1960*	402.7	46.0	158.0	607.3†	176.48	85.23	1,723.91	266.11	0.88

Source: Federal Power Commission. * Preliminary. † Small amount of energy generated from wood, waste and nuclear fuel included in total.

CHANGES IN INSTALLED GENERATING CAPACITY–MW (NAMEPLATE)

	New Additions	Retirements	Adjustments* Plus	Adjustments* Minus	Net Additions
1952					
Hydro	1,460	14	116	11	1,551
Steam	4,892	142	316	252	4,814
Internal Combustion	105	43	45	21	86
Total	**6,457**	**199**	**477**	**284**	**6,451**
1953					
Hydro	1,632	21	24	9	1,626
Steam	7,803	221	129	155	7,556
Internal Combustion	86	34	46	4	94
Total	**9,521**	**276**	**199**	**168**	**9,276**
1954					
Hydro	1,148	19	67	30	1,166
Steam	10,287	450	211	181	9,867
Internal Combustion	97	39	38	39	57
Total	**11,532**	**508**	**316**	**250**	**11,090**
1955					
Hydro	1,500	24	331	13	1,794
Steam	10,383	587	353	139	10,010
Internal Combustion	87	47	44	8	76
Total	**11,970**	**658**	**728**	**160**	**11,880**
1956					
Hydro	918	253	...	103	562
Steam	5,288	276	356	17	5,351
Internal Combustion	69	22	9	6	50
Total	**6,275**	**551**	**365**	**126**	**5,963**
1957					
Hydro	1,294	13	105	4	1,382
Steam	6,648	301	652	48	6,951
Internal Combustion	97	31	32	5	93
Total	**8,039**	**345**	**789**	**57**	**8,426**
1958					
Hydro	2,353	10	9	25	2,327
Steam	10,818	449	555	31	10,893
Internal Combustion	75	35	32	2	70
Total	**13,246**	**494**	**596**	**58**	**13,290**
1959					
Hydro	1,782	66	3	4	1,715
Steam	11,793	525	1,235	52	12,451
Internal Combustion	85	29	28	6	78
Total	**13,660**	**620**	**1,266**	**62**	**14,244**
1960†					
Hydro	1,418	123	7	3	1,299
Steam	9,553	554	300	71	9,228
Internal Combustion	134	19	13	19	109
Total	**11,105**	**696**	**320**	**93**	**10,636**

Source: Edison Electric Institute and Federal Power Commission. † Preliminary. *Adjustments are result of reclassification in ownership between industrial and electric utility plants and rerating of turbines within the electric utility industry.

NUMBER & INSTALLED CAPACITY OF ELECTRIC UTILITY GENERATING PLANTS BY STATES & TYPE OF PRIME MOVER–KW

December 31, 1960 (Preliminary)

	Number of Utilities [a]	Number of Plants [b]	Total Capacity (Kilowatts)	Hydro		Steam		Internal Combustion	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	**1,306**	**3,441**	**167,476,969**	**1,333**	**32,373,350**	**1,057**	**132,313,021**	**1,051**	**2,790,598**
New England	**81**	**301**	**7,045,837**	**188**	**1,255,264**	**75**	**5,659,492**	**38**	**131,081**
Maine	18	86	743,281	57	351,213	10	337,748	19	54,320
New Hampshire	11	40	762,446	32	397,680	7	361,750	1	3,016
Vermont	12	67	261,065	53	186,470	7	58,150	7	16,445
Massachusetts	24	65	2,971,378	29	185,856	29	2,753,529	7	31,993
Rhode Island	6	11	427,327	3	2,475	5	409,825	3	15,027
Connecticut	10	32	1,880,340	14	131,570	17	1,738,490	1	10,280
Middle Atlantic	**74**	**290**	**25,540,711**	**148**	**2,391,076**	**117**	**23,063,496**	**25**	**86,139**
New York	38	194	11,821,991	138	1,952,076	43	9,823,050	13	46,865
New Jersey	10	22	4,537,886	2	6,080	18	4,526,624	2	5,182
Pennsylvania	26	74	9,180,834	8	432,920	56	8,713,822	10	34,092
East North Central	**240**	**591**	**36,630,575**	**234**	**832,028**	**216**	**35,365,027**	**141**	**433,520**
Ohio	45	79	10,445,268	3	5,575	58	10,383,962	18	55,731
Indiana	33	62	6,569,036	12	31,370	38	6,498,190	12	39,476
Illinois	51	94	9,357,766	9	38,319	54	9,210,700	31	108,747
Michigan	58	172	6,767,504	96	380,614	35	6,215,250	41	171,640
Wisconsin	53	184	3,491,001	114	376,150	31	3,056,925	39	57,926
West North Central	**427**	**802**	**11,471,468**	**101**	**1,551,701**	**219**	**8,794,631**	**482**	**1,125,136**
Minnesota	77	168	2,418,753	35	152,485	51	2,065,720	82	200,548
Iowa	87	185	1,979,886	20	136,178	47	1,560,771	118	282,937
Missouri	65	98	2,690,998	5	292,600	37	2,243,700	56	154,698
North Dakota	12	42	665,678	1	400,000	18	224,790	23	40,888
South Dakota	32	60	545,203	7	324,496	10	151,750	43	68,957
Nebraska	72	119	1,224,322	29	240,032	19	843,150	71	141,140
Kansas	82	130	1,946,628	4	5,910	37	1,704,750	89	235,968
South Atlantic	**120**	**345**	**22,702,061**	**158**	**3,597,447**	**127**	**18,910,561**	**60**	**194,053**
Delaware	4	6	425,240	.....	.....	4	416,500	2	8,740
Maryland	11	21	2,077,424	3	271,325	14	1,789,000	4	17,099
District of Columbia	2	3	533,000	1	3,000	2	530,000	.....	.....
Virginia	21	59	3,570,149	33	396,196	15	3,153,936	11	20,017
West Virginia	9	32	3,216,709	10	100,880	15	3,112,445	7	3,384
North Carolina	26	80	4,396,782	54	1,206,450	18	3,179,250	8	11,082
South Carolina	13	39	2,254,739	26	937,725	10	1,315,500	3	1,514
Georgia	7	39	2,236,190	27	639,690	12	1,596,500	.....	.....
Florida	27	66	3,991,828	4	42,181	37	3,817,430	25	132,217
East South Central	**35**	**108**	**16,614,710**	**43**	**3,742,080**	**46**	**12,851,801**	**19**	**20,829**
Kentucky	8	19	3,361,853	5	540,860	12	2,812,966	2	8,027
Tennessee	6	37	7,520,798	26	1,910,000	9	5,610,500	2	298
Alabama	5	27	4,699,870	12	1,291,220	12	3,406,250	3	2,400
Mississippi	16	25	1,032,189	.....	.....	13	1,022,085	12	10,104
West South Central	**143**	**324**	**16,094,416**	**35**	**944,200**	**124**	**14,656,621**	**165**	**493,595**
Arkansas	14	28	1,178,180	8	388,340	10	750,545	10	39,295
Louisiana	30	57	2,909,729	.....	.....	21	2,772,600	36	137,129
Oklahoma	38	62	2,225,264	3	165,400	22	1,954,734	37	105,130
Texas	61	177	9,781,243	24	390,460	71	9,178,742	82	212,041
Mountain	**135**	**373**	**8,686,870**	**188**	**4,618,989**	**77**	**3,814,571**	**108**	**253,310**
Montana	9	28	1,353,192	20	1,234,950	5	115,800	3	2,442
Idaho	12	46	1,254,825	41	1,250,435	.....	.....	5	4,390
Wyoming	17	52	382,495	20	189,982	10	176,860	22	15,653
Colorado	37	76	1,316,592	27	252,892	24	1,009,768	25	53,932
New Mexico	14	30	803,657	2	24,630	14	730,900	14	48,127
Arizona	12	40	2,235,883	12	980,040	14	1,197,926	14	57,917
Utah	26	83	620,274	57	99,780	9	479,317	17	41,177
Nevada	8	18	719,952	9	586,280	1	104,000	8	29,672
Pacific	**51**	**307**	**22,690,321**	**238**	**13,440,565**	**56**	**9,196,821**	**13**	**52,935**
Washington	19	57	7,214,558	45	6,974,394	8	237,000	4	3,164
Oregon	12	70	2,613,977	53	2,414,047	12	194,710	5	5,220
California	20	180	12,861,786	140	4,052,124	36	8,765,111	4	44,551

Notes: [a] Total includes 108 duplications because of utilities having generating plants in more than one state.
[b] Each type of prime mover at combination plants is counted as a separate plant.

NEW ENGLAND

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Bangor Hydro Electric	Hydro	39,200	.....	.....	.....	.....	.....	.....
	Steam	28,000	.....	.....	.....	20,000	.....	20,000
	IC	26,000	8,000	8,000	8,000	.....	.....	16,000
	Total	93,200	8,000	8,000	8,000	20,000	.....	36,000
Boston Edison	Hydro	40	.....	.....	.....	.....	.....	.....
	Steam	1,186,800	.....	145,000	.....	.....	.....	145,000
	Total	1,186,840	.....	145,000	.....	.....	.....	145,000
Central Maine Power	Hydro	267,879	.....	.....	.....	.....	.....	.....
	Steam	273,500	.....	.....	.....	.....	67,000	67,000
	IC	6,576	.....	.....	.....	.....	.....	.....
	Total	547,955	.....	.....	.....	.....	67,000	67,000
Central Vermont P S	Hydro	40,000	.....	.....	10,000	.....	.....	10,000
	Steam	4,000	.....	.....	.....	.....	.....	.....
	IC	20,300	.....	10,750	10,750	.....	.....	21,500
	Total	64,300	.....	10,750	20,750	.....	.....	31,500
Connecticut L & P	Hydro	120,650	.....	.....	.....	.....	.....	.....
	Steam	835,500	158,000	.....	160,000	.....	.....	160,000
	IC	22,000	.....	.....	.....	.....	.....	.....
	Total	978,150	158,000	.....	160,000	.....	.....	160,000
Green Mountain Power	Hydro	25,680	.....	.....	.....	.....	.....	.....
	Steam	36,000	.....	.....	.....	.....	.....	.....
	IC	4,000	.....	.....	.....	.....	2,000	2,000
	Total	65,680	.....	.....	.....	.....	2,000	2,000
Hartford Electric Lt	Hydro	10,185	.....	.....	.....	.....	.....	.....
	Steam	499,140	.....	.....	.....	.....	150,000	150,000
	Total	509,325	.....	.....	.....	.....	150,000	150,000
Holyoke Power & Light (Holyoke Water Power)	Hydro	26,056	.....	.....	.....	.....	.....	.....
	Steam	167,500	125,000	.....	.....	.....	.....	.....
	Total	193,556	125,000	.....	.....	.....	.....	.....
Maine Public Service	Hydro	2,300	.....	.....	.....	.....	.....	.....
	Steam	19,000	.....	.....	.....	16,500	.....	16,500
	IC	13,300	.....	.....	2,000	.....	.....	2,000
	Total	34,600	.....	.....	2,000	16,500	.....	18,500
New England Electric System	Hydro	553,130	.....	.....	.....	.....	.....	.....
	Steam	874,400	.....	.....	.....	250,000	250,000	500,000
	IC	9,900	.....	.....	.....	.....	.....	.....
	Total	1,437,430	.....	.....	.....	250,000	250,000	500,000
New England G & E	Steam	222,250	.....	.....	.....	.....	225,000	225,000
	IC	2,527	.....	.....	.....	.....	.....	.....
	Total	224,777	.....	.....	.....	.....	225,000	225,000

Middle Atlantic (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Central Hudson G & E	Hydro	47,020	.....	.....	.....	.....	.....	.....
	Steam	259,000	.....	.....	.....	.....	140,000	140,000
	Total	306,020	.....	.....	.....	.....	140,000	140,000
Consolidated Edison	Steam	4,883,000	.....	375,000	573,000	760,000	.....	1,708,000
Duquesne Light	Steam	1,287,500	172,000	.....	.....	.....	.....	.....
Long Island Lighting	Steam	1,256,500	185,000	.....	.....	185,000	.....	185,000
	IC	4,000	4,000	.....	8,000	.....	.....	8,000
	Total	1,260,500	189,000	.....	8,000	185,000	.....	193,000
Metropolitan Edison	Hydro	19,620	.....	.....	.....	.....	.....	.....
	Steam	595,500	.....	.....	250,000	.....	.....	250,000
	Total	615,120	.....	.....	250,000	.....	.....	250,000
New Jersey P & L	Hydro	.....	.....	.....	.....	.....	412,500	412,500
	Steam	125,000	.....	.....	.....	.....	.....	.....
	Total	125,000	.....	.....	.....	.....	412,500	412,500
Niagara Mohawk Power	Hydro	881,962	.....	.....	.....	.....	.....	.....
	Steam	2,612,000	210,000	.....	.....	.....	.....	.....
	IC	4,000	.....	.....	.....	.....	.....	.....
	Total	3,497,962	210,000	.....	.....	.....	.....	.....
Orange & Rockland Utilities	Hydro	43,800	.....	.....	.....	.....	.....	.....
	Steam	131,600	.....	.....	.....	.....	140,000	140,000
	Total	175,400	.....	.....	.....	.....	140,000	140,000
Pennsylvania Electric	Hydro	52,700	.....	.....	.....	.....	.....	.....
	Steam	1,047,304	.....	.....	.....	.....	.....	.....
	IC	4,000	4,000	.....	.....	.....	.....	.....
	Total	1,104,004	4,000	.....	.....	.....	.....	.....
Pennsylvania Power	Steam	268,000	.....	.....	.....	.....	120,000	120,000
Pennsylvania P & L	Hydro	144,000	.....	.....	.....	.....	.....	.....
	Steam	1,286,500	.....	300,000	.....	.....	300,000	600,000
	Total	1,430,500	.....	300,000	.....	.....	300,000	600,000
Philadelphia Electric	Hydro	253,000	.....	.....	.....	.....	.....	.....
	Steam	3,180,250	650,000	.....	.....	.....	.....	.....
	IC	6,000	.....	42,000	.....	.....	.....	42,000
	Total	3,439,250	650,000	42,000	.....	.....	.....	42,000
Public Service E & G	Steam	3,474,300	610,000	320,000	342,000	.....	342,000	1,004,000

New England (continued)

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Newport Electric	Steam	10,500	.....	.....	.....	.....	.....	.....
	IC	4,000	4,000	4,000	.....	.....	.....	4,000
	Total	14,500	4,000	4,000	.....	.....	.....	4,000
Public Service Co of New Hampshire	Hydro	73,230	.....	.....	.....	.....	.....	.....
	Steam	361,750	100,000	.....	.....	.....	.....	.....
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	437,980	100,000	.....	.....	.....	.....	.....
United Illuminating	Steam	419,700	.....	160,000	.....	.....	.....	160,000
Western Massachusetts Electric	Hydro	106,600	.....	.....	.....	.....	.....	.....
	Steam	283,736	.....	.....	.....	.....	150,000	150,000
	Total	390,336	.....	.....	.....	.....	150,000	150,000
Yankee Atomic Electric	Steam	145,000	145,000	.....	.....	.....	.....	.....
Total	**Hydro**	**1,264,950**	.....	.....	**10,000**	.....	.....	**10,000**
	Steam	**5,366,776**	**528,000**	**305,000**	**160,000**	**286,500**	**842,000**	**1,593,500**
	IC	**111,603**	**12,000**	**22,750**	**20,750**	.....	**2,000**	**45,500**
	Total	**6,743,329**	**540,000**	**327,750**	**190,750**	**286,500**	**844,000**	**1,649,000**
Municipal, State and Power District Systems								
Burlington, Vt.	Steam	30,000	.....	.....	.....	.....	24,000	24,000
Hudson, Mass.	IC	12,000	3,000	.....	.....	.....	5,000	5,000
Ipswich, Mass.	IC	7,835	1,000	1,360	.....	.....	.....	1,360
Norwalk, Conn.	Steam	.....	4,000	.....	.....	.....	.....	.....
Total	**Steam**	**30,000**	**4,000**	.....	.....	.....	**24,000**	**24,000**
	IC	**19,835**	**4,000**	**1,360**	.....	.....	**5,000**	**6,360**
	Total	**49,835**	**8,000**	**1,360**	.....	.....	**29,000**	**30,360**
New England	**Hydro**	**1,264,950**	.....	.....	**10,000**	.....	.....	**10,000**
Total All Agencies	**Steam**	**5,396,776**	**532,000**	**305,000**	**160,000**	**286,500**	**866,000**	**1,617,500**
	IC	**131,438**	**16,000**	**24,110**	**20,750**	.....	**7,000**	**51,860**
	Total	**6,793,164**	**548,000**	**329,110**	**190,750**	**286,500**	**873,000**	**1,679,360**

MIDDLE ATLANTIC

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Atlantic City Electric	Steam	441,500	.....	.....	136,000	.....	.....	136,000
	IC	500	.....	8,000	.....	.....	.....	8,000
	Total	442,000	.....	8,000	136,000	.....	.....	144,000

Middle Atlantic (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Rochester G & E	Hydro	21,300	2,000	.....	.....	.....	.....	.....
	Steam	474,000	.....	.....	.....	.....	.....	.....
	Total	495,300	2,000	.....	.....	.....	.....	.....
Total	**Hydro**	**1,463,402**	**2,000**	.....	.....	.....	**412,500**	**412,500**
	Steam	**21,321,954**	**1,827,000**	**995,000**	**1,301,000**	**945,000**	**1,042,000**	**4,283,000**
	IC	**18,500**	**8,000**	**50,000**	**8,000**	.....	.....	**58,000**
	Total	**22,803,856**	**1,837,000**	**1,045,000**	**1,309,000**	**945,000**	**1,454,500**	**4,753,500**
Municipal, State and Power District Systems								
Grove City, Pa.	IC	7,685	2,000	.....	.....	.....	.....	.....
Lake Placid, N. Y.	Hydro	475	332	.....	.....	.....	.....	.....
Lansdale, Pa.	Steam	25,000	.....	12,500	.....	.....	12,500	25,000
N. Y. State Power Authority	Hydro	912,000	.....	1,580,000	610,000	.....	.....	2,190,000
Rockville Center, N. Y.	IC	15,148	.....	3,500	.....	2,000	.....	5,500
Vineland, N. J.	Steam	53,500	16,500	.....	.....	.....	.....	.....
Total	**Hydro**	**912,475**	**332**	**1,580,000**	**610,000**	.....	.....	**2,190,000**
	Steam	**78,500**	**16,500**	**12,500**	.....	.....	**12,500**	**25,000**
	IC	**22,833**	**2,000**	**3,500**	.....	**2,000**	.....	**5,500**
	Total	**1,013,808**	**18,832**	**1,596,000**	**610,000**	**2,000**	**12,500**	**2,220,500**
Middle Atlantic	**Hydro**	**2,375,877**	**2,332**	**1,580,000**	**610,000**	.....	**412,500**	**2,602,500**
Total All Agencies	**Steam**	**21,400,454**	**1,843,500**	**1,007,500**	**1,301,000**	**945,000**	**1,054,500**	**4,308,000**
	IC	**41,333**	**10,000**	**53,500**	**8,000**	**2,000**	.....	**63,500**
	Total	**23,817,664**	**1,855,832**	**2,641,000**	**1,919,000**	**947,000**	**1,467,000**	**6,974,000**

EAST NORTH CENTRAL

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Central Illinois E & G	Hydro	1,200	.....	.....	.....	.....	.....	.....
	Steam	155,250	.....	55,000	.....	.....	.....	55,000
	Total	156,450	.....	55,000	.....	.....	.....	55,000
Central Illinois Lt.	Steam	451,400	125,000	.....	.....	.....	125,000	125,000
	IC	2,100	.....	.....	.....	.....	.....	.....
	Total	453,500	125,000	.....	.....	.....	125,000	125,000
Central Illinois P. S.	Steam	680,000	200,000	.....	.....	.....	.....	.....

East North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Cincinnati G & E	Steam	1,239,000	172,000	.....	250,000	.....	250,000	500,000
Cleveland Electric	Steam	2,021,000	.....	.....	247,000	.....	.....	247,000
Columbus and Southern Ohio	Steam	765,000	.....	.....	125,000	.....	.....	125,000
Commonwealth Edison	Steam	5,206,000	180,000	305,000	610,000	510,000	.....	1,425,000
Consumers Power	Hydro	150,940	.....	.....	.....	.....	.....	.....
	Steam	2,120,100	.....	265,000	315,000	.....	265,000	845,000
	IC	7,522	.....	.....	.....	.....	.....	.....
	Total	2,278,562	.....	265,000	315,000	.....	265,000	845,000
Dayton P & L	Steam	770,000	.....	.....	.....	.....	250,000	250,000
Detroit Edison	Hydro	7,850	.....	.....	.....	.....	.....	.....
	Steam	3,760,100	.....	325,000	150,000	.....	.....	475,000
	Total	3,767,950	.....	325,000	150,000	.....	.....	475,000
Edison Sault Electric	IC	9,934	2,000	.....	2,000	2,000	2,000	6,000
Illinois Power	Hydro	2,800	.....	.....	.....	.....	.....	.....
	Steam	1,056,900	.....	.....	.....	.....	300,000	300,000
	IC	2,000	.....	.....	.....	.....	.....	.....
	Total	1,061,700	.....	.....	.....	.....	300,000	300,000
Indiana & Michigan Electric	Hydro	23,504	.....	.....	.....	.....	.....	.....
	Steam	1,437,500	500,000	.....	.....	.....	.....	.....
	IC	4,250	.....	.....	.....	.....	.....	.....
	Total	1,465,254	500,000	.....	.....	.....	.....	.....
Indianapolis P & L	Steam	725,000	.....	108,000	.....	.....	.....	108,000
Lake Superior District Power	Hydro	13,140	.....	.....	.....	.....	.....	.....
	Steam	92,000	20,000	.....	.....	.....	.....	.....
	IC	4,000	.....	.....	.....	.....	12,000	12,000
	Total	109,140	20,000	.....	.....	.....	12,000	12,000
Madison Gas & Electric	Steam	132,000	.....	44,000	.....	.....	.....	44,000
Northern Indiana P. S.	Hydro	10,780	.....	.....	.....	.....	.....	.....
	Steam	593,000	.....	.....	193,000	.....	.....	193,000
	Total	603,780	.....	.....	193,000	.....	.....	193,000
Northern States Power	Hydro	165,520	6,000	.....	.....	.....	.....	.....
	Steam	31,500	.....	.....	.....	.....	.....	.....
	IC	9,000	.....	.....	.....	.....	.....	.....
	Total	206,020	6,000	.....	.....	.....	.....	.....

East North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Grand Haven, Mich.	Steam	3,000	.....	18,750	.....	.....	.....	18,750
	IC	18,000	.....	.....	.....	.....	.....	.....
	Total	21,000	.....	18,750	.....	.....	.....	18,750
Hamilton, Ohio	Steam	74,000	24,000	.....	.....	.....	.....	.....
Highland, Ill.	Steam	18,500	6,000	.....	.....	.....	.....	.....
Holland, Mich.	Steam	31,500	.....	22,000	.....	.....	22,000	44,000
Lansing, Mich.	Hydro	1,000	.....	.....	.....	.....	.....	.....
	Steam	190,000	.....	44,000	.....	.....	62,000	106,000
	Total	191,000	.....	44,000	.....	.....	62,000	106,000
Manitowoc, Wis.	Steam	52,000	.....	.....	.....	.....	22,000	22,000
Marshfield, Wis.	Steam	12,500	.....	.....	.....	12,500	.....	12,500
Oberlin, Ohio	IC	.....	.....	2,500	.....	.....	2,500	5,000
Orrville, Ohio	Steam	38,500	22,000	.....	.....	.....	22,000	22,000
Peru, Ill.	Steam	24,875	9,375	.....	.....	.....	.....	.....
Piqua, Ohio	Steam	33,000	.....	20,000	.....	.....	.....	20,000
Rantoul, Ill.	IC	8,032	1,600	1,600	.....	.....	.....	1,600
Rensselaer, Ind.	IC	7,080	.....	.....	.....	.....	3,000	3,000
Rochelle, Ill.	Steam	9,600	.....	12,500	.....	.....	.....	12,500
Shelby, Ohio	Steam	17,000	.....	.....	7,500	.....	.....	7,500
Springfield, Ill.	Steam	80,000	.....	33,000	.....	.....	.....	33,000
Sullivan, Ill.	IC	5,035	.....	2,000	.....	.....	.....	2,000
Winnetka, Ill.	Steam	25,500	10,000	.....	.....	.....	.....	.....
Zeeland, Mich.	IC	6,646	.....	.....	.....	.....	3,000	3,000
Total	**Hydro**	**1,000**	.....	.....	.....	.....	.....	.....
	Steam	**992,975**	**78,875**	**153,250**	**7,500**	**109,000**	**208,000**	**477,750**
	IC	**68,330**	**3,700**	**9,350**	**4,500**	**3,000**	**14,000**	**30,850**
	Total	**1,062,305**	**82,575**	**162,600**	**12,000**	**112,000**	**222,000**	**508,600**
Cooperatives								
Dairyland Power Coop	Hydro	23,700	.....	.....	.....	.....	.....	.....
	Steam	271,700	87,000	.....	.....	.....	.....	.....
	IC	13,000	.....	.....	.....	.....	.....	.....
	Total	308,400	87,000	.....	.....	.....	.....	.....
Washington Island Electric Coop	IC	570	.....	150	.....	.....	.....	150

East North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Northwestern Wisconsin Electric	Hydro	1,312	.....	.....	.....	.....	.....	.....
	IC	4,170	700	700	.....	.....	.....	700
	Total	5,482	700	700	.....	.....	.....	700
Ohio Edison.....	Steam	1,897,500	173,000	173,000	173,000	.....	.....	346,000
Public Service Co of Indiana	Steam	1,453,000	150,000	150,000	.....	.....	.....	150,000
Toledo Edison.....	Hydro	4,000	.....	.....	.....	.....	.....	.....
	Steam	636,000	.....	.....	.....	141,000	141,000	282,000
	Total	640,000	.....	.....	.....	141,000	141,000	282,000
Wisconsin Electric Power	Hydro	240	.....	.....	.....	.....	.....	.....
	Steam	1,592,500	.....	275,000	.....	.....	.....	275,000
	Total	1,592,740	.....	275,000	.....	.....	.....	275,000
Wisconsin P & L.....	Hydro	41,800	.....	.....	.....	.....	.....	.....
	Steam	433,200	.....	.....	100,000	.....	100,000	200,000
	Total	475,000	.....	.....	100,000	.....	100,000	200,000
Wisconsin P. S.....	Hydro	44,933	.....	.....	.....	.....	.....	.....
	Steam	438,300	86,000	.....	.....	.....	100,000	100,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	486,233	86,000	.....	.....	.....	100,000	100,000
Total.....	**Hydro**	**468,019**	**6,000**	.....	.....	.....	.....	.....
	Steam	**27,686,250**	**1,606,000**	**1,700,000**	**2,163,000**	**651,000**	**1,531,000**	**6,045,000**
	IC	**45,976**	**2,700**	**700**	**2,000**	**2,000**	**14,000**	**18,700**
	Total	**28,200,245**	**1,614,700**	**1,700,700**	**2,165,000**	**653,000**	**1,545,000**	**6,063,700**
Municipal, State and Power District Systems								
Bloomington, Ill.....	IC	6,137	2,100	.....	.....	3,000	.....	3,000
Bryan, Ohio.....	IC	6,250	.....	.....	4,500	.....	.....	4,500
Bushnell, Ill.....	IC	3,900	.....	.....	.....	.....	2,000	2,000
Celina, Ohio.....	Steam	12,500	7,500	.....	.....	.....	.....	.....
Cleveland, Ohio....	Steam	137,000	.....	.....	.....	75,000	.....	75,000
Coldwater, Mich....	Steam	4,500	.....	3,000	.....	5,000	.....	8,000
	IC	2,000	.....	.....	.....	.....	.....	.....
	Total	6,500	.....	3,000	.....	5,000	.....	8,000
Detroit, Mich.....	Steam	170,000	.....	.....	.....	.....	40,000	40,000
Dover, Ohio.....	Steam	15,000	.....	.....	.....	.....	15,000	15,000
Escanaba, Mich.....	Steam	25,000	.....	.....	.....	.....	25,000	25,000
Frankfort, Ind.....	Steam	19,000	.....	.....	.....	16,500	.....	16,500
Geneseo, Ill.....	IC	5,250	.....	3,250	.....	.....	3,500	6,750

East North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Wolverine Electric Coop	IC	24,900	.....	3,000	.....	.....	.....	3,000
Total.....	**Hydro**	**23,700**	.....	.....	.....	.....	.....	.....
	Steam	**271,700**	**87,000**	.....	.....	.....	.....	.....
	IC....	**38,470**	.....	**3,150**	.....	.....	.....	**3,150**
	Total	**333,870**	**87,000**	**3,150**	.....	.....	.....	**3,150**
East North Central	**Hydro**	**492,719**	**6,000**	.....	.....	.....	.....	.....
Total All Agencies	**Steam**	**28,950,925**	**1,771,875**	**1,853,250**	**2,170,500**	**760,000**	**1,739,000**	**6,522,750**
	IC	**152,776**	**6,400**	**13,200**	**6,500**	**5,000**	**28,000**	**52,700**
	Total	**29,596,420**	**1,784,275**	**1,866,450**	**2,177,000**	**765,000**	**1,767,000**	**6,575,450**

WEST NORTH CENTRAL

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Black Hills P & L.....	Hydro	1,346	.....	.....	.....	.....	.....	.....
	Steam	102,500	22,000	.....	.....	.....	44,000	44,000
	IC	7,880	.....	.....	.....	.....	.....	.....
	Total	111,726	22,000	.....	.....	.....	44,000	44,000
Central E & G.....	Hydro	250	.....	.....	.....	.....	.....	.....
	IC	7,335	.....	1,000	.....	1,000	2,000	4,000
	Total	7,585	.....	1,000	.....	1,000	2,000	4,000
Central Kansas Power..	Steam	67,650	.....	.....	.....	.....	48,000	48,000
	IC	5,535	.....	.....	.....	.....	.....	.....
	Total	73,185	.....	.....	.....	.....	48,000	48,000
Interstate Power.....	Hydro	2,400	.....	.....	.....	.....	.....	.....
	Steam	251,800	.....	.....	84,000	.....	.....	84,000
	IC	5,840	2,000	.....	.....	.....	.....	.....
	Total	260,040	2,000	.....	84,000	.....	.....	84,000
Iowa Electric L & P.....	Hydro	2,500	.....	.....	.....	.....	.....	.....
	Steam	223,400	.....	75,000	.....	.....	.....	75,000
	IC	49,010	2,200	.....	.....	.....	.....	.....
	Total	274,910	2,200	75,000	.....	.....	.....	75,000
Iowa-Illinois G & E....	Hydro	4,000	.....	.....	.....	.....	.....	.....
	Steam	240,079	.....	125,000	.....	.....	.....	125,000
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	245,079	.....	125,000	.....	.....	.....	125,000
Iowa P & L.....	Steam	366,036	.....	.....	.....	.....	144,000	144,000
	IC	4,848	.....	.....	.....	.....	.....	.....
	Total	370,884	.....	.....	.....	.....	144,000	144,000

West North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Iowa Public Service	Hydro	461						
	Steam	239,499					145,000	145,000
	IC	29,324						
	Total	269,284					145,000	145,000
Kansas City P & L	Steam	943,250	186,000				186,000	186,000
Kansas Gas & Electric	Steam	618,000		160,000			160,000	320,000
Kansas P & L	Steam	572,100	128,000		165,000			165,000
	IC	2,100						
	Total	574,200	128,000		165,000			165,000
Minnesota P & L	Hydro	106,665						
	Steam	357,950	70,000					
	Total	464,615	70,000					
Missouri P S	Hydro	1,600						
	Steam	71,000	45,500	45,500				45,500
	IC	4,453						
	Total	77,053	45,500	45,500				45,500
Missouri Utilities	Steam	24,500						
	IC	2,000					2,000	2,000
	Total	26,500					2,000	2,000
Northern States Power	Hydro	34,960						
	Steam	1,423,800	231,000		66,000		220,000	286,000
	IC	30,415						
	Total	1,489,175	231,000		66,000		220,000	286,000
Northwestern P S	Steam	28,500					33,000	33,000
	IC	16,383	1,360	15,000	3,000			18,000
	Total	44,883	1,360	15,000	3,000		33,000	51,000
Otter Tail Power	Hydro	5,480						
	Steam	157,250					160,000	160,000
	IC	22,675						
	Total	185,405					160,000	160,000
St. Joseph L & P	Steam	100,000			14,000			14,000
	IC	2,000						
	Total	102,000			14,000			14,000
Union Electric	Hydro	329,000				350,000		350,000
	Steam	1,541,000		372,000			350,000	722,000
	Total	1,870,000		372,000		350,000	350,000	1,072,000
Western Light & Telephone	Steam	85,700				63,000		63,000
	IC	16,700						
	Total	102,400				63,000		63,000

West North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Hoisington, Kan	IC	5,220	2,000					
Horton, Kan	IC	3,015	1,350				1,350	1,350
Hugoton, Kan	IC	4,060					2,000	2,000
Kansas City, Mo	Steam	194,410			60,000			60,000
Kennett, Mo	IC	12,556	2,500			2,500		2,500
Kimball, Neb	IC	5,960	2,500					
Le Sueur, Minn	IC				1,500			1,500
Litchfield, Minn	Steam	3,750				7,500		7,500
	IC	4,000						
	Total	7,750				7,500		7,500
Luverne, Minn	Steam	4,100				6,000		6,000
	IC	800						
	Total	4,900				6,000		6,000
McPherson, Kan	Steam	26,500			22,000		22,000	44,000
	IC	1,000						
	Total	27,500			22,000		22,000	44,000
Moorhead, Minn	Steam	12,000				11,500		11,500
	IC	10,000	10,000					
	Total	22,000	10,000			11,500		11,500
Mountain Lake, Minn	IC	3,673	1,360					
Nebraska Public Power System	Hydro	129,601						
	Steam	246,500					150,000	150,000
	IC	2,976						
	Total	379,077					150,000	150,000
Neodesha, Kan	IC	5,235			2,250			2,250
New Ulm, Minn	Steam	14,500				12,500		12,500
North Branch, Minn	IC	1,400	900			1,200		1,200
Omaha Public Power District	Steam	455,000				135,000		135,000
Orange City, Iowa	Hydro			4,000				4,000
	IC	3,625						
	Total	3,625		4,000				4,000
Popular Bluff, Mo	Steam	14,500	7,500				7,500	7,500
Rochester, Minn	Hydro	1,840						
	Steam	31,500			22,000			22,000
	Total	33,340			22,000			22,000

West North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Total	**Hydro**	**488,662**	.....	.....	.....	**350,000**	.....	**350,000**
	Steam	**7,414,014**	**682,500**	**777,500**	**329,000**	**63,000**	**1,490,000**	**2,659,500**
	IC	**207,498**	**5,560**	**16,000**	**3,000**	**1,000**	**4,000**	**24,000**
	Total	**8,110,174**	**688,060**	**793,500**	**332,000**	**414,000**	**1,494,000**	**3,033,500**
Municipal, State and Power District Systems								
Ames, Iowa	Steam	28,150	.....	.....	.....	.....	15,000	15,000
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	29,150	.....	.....	.....	.....	15,000	15,000
Auburn, Neb	Hydro	.....	.....	200	.....	.....	3,450	3,650
Austin, Minn	Steam	33,500	7,500	.....	.....	.....	.....	.....
Barnesville, Minn	IC	.....	.....	800	.....	.....	.....	800
Bellevue, Iowa	IC	2,370	.....	.....	.....	1,000	.....	1,000
Blue Earth, Minn	Steam	4,000	.....	1,500	.....	.....	.....	1,500
Carthage, Mo	IC	15,000	.....	.....	.....	.....	5,000	5,000
Columbia, Mo	Steam	35,000	.....	.....	.....	22,000	.....	22,000
Consumers Public Power District	Hydro	8,940	.....	.....	.....	.....	.....	.....
	Steam	25,125	.....	100,000	.....	.....	116,500	216,500
	IC	13,150	.....	.....	.....	.....	.....	.....
	Total	47,215	.....	100,000	.....	.....	116,500	216,500
Deshler, Neb	IC	1,570	.....	.....	.....	.....	1,000	1,000
Elk River, Minn	Hydro	230	.....	.....	.....	.....	.....	.....
	IC	1,100	.....	2,200	.....	.....	.....	2,200
	Total	1,330	.....	2,200	.....	.....	.....	2,200
Ellis, Kan	IC	2,750	1,000	.....	.....	.....	.....	.....
Emerson, Neb	IC	850	450	.....	.....	.....	.....	.....
Fairfax, Minn	IC	.....	.....	1,000	.....	.....	.....	1,000
Fairmont, Minn	Steam	22,000	.....	.....	.....	.....	16,500	16,500
Fremont, Neb	Steam	37,500	.....	.....	22,000	.....	.....	22,000
Girard, Kan	IC	3,097	.....	.....	2,000	.....	.....	2,000
Grundy Center, Iowa	Steam	1,250	.....	.....	.....	.....	.....	.....
	IC	.....	.....	.....	.....	.....	1,500	1,500
	Total	1,250	.....	.....	.....	.....	1,500	1,500
Hartley, Iowa	Hydro	.....	.....	.....	.....	1,500	.....	1,500
	IC	2,300	.....	.....	.....	1,500	.....	1,500
	Total	2,300	.....	.....	.....	3,000	.....	3,000

West North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Russell, Kan	IC	11,471	.....	.....	.....	3,500	.....	3,500
Spencer, Iowa	Steam	17,500	7,500	.....	.....	.....	.....	.....
Springfield, Minn	Steam	7,750	4,000	.....	.....	.....	.....	.....
Springfield, Mo	Steam	44,000	.....	.....	.....	.....	66,000	66,000
Spring Valley, Minn	IC	4,697	2,000	.....	.....	.....	.....	.....
Stanbury, Mo	IC	1,250	.....	.....	.....	.....	1,000	1,000
Stockton, Kan	IC	2,827	.....	.....	900	.....	.....	900
Telumseh, Neb	IC	2,852	1,360	.....	.....	.....	.....	.....
Villisca, Iowa	IC	2,046	1,500	.....	.....	.....	.....	.....
Virginia, Minn	Steam	17,500	.....	.....	.....	7,500	.....	7,500
Waverly, Iowa	Hydro	495	.....	.....	.....	.....	.....	.....
	IC	8,945	.....	.....	.....	1,500	4,000	5,500
	Total	9,440	.....	.....	.....	1,500	4,000	5,500
Wayne, Neb	IC	6,500	2,000	.....	.....	.....	2,500	2,500
Webster City, Iowa	Steam	15,375	7,500	.....	.....	.....	.....	.....
West Bend, Iowa	IC	4,251	1,183	.....	.....	.....	.....	.....
West Point, Neb	IC	3,115	1,250	.....	.....	.....	.....	.....
Westbrook, Minn	IC	830	.....	.....	.....	2,000	.....	2,000
Total	**Hydro**	**141,106**	.....	**4,200**	.....	**1,500**	**3,450**	**9,150**
	Steam	**1,291,410**	**34,000**	**101,500**	**126,000**	**202,000**	**393,500**	**823,000**
	IC	**155,491**	**31,353**	**4,000**	**6,650**	**13,200**	**18,350**	**42,200**
	Total	**1,588,007**	**65,353**	**109,700**	**132,650**	**216,700**	**415,300**	**874,350**
Cooperatives								
Central Electric Power	Steam	60,000	45,000	.....	.....	.....	.....	.....
Corn Belt Power Coop	Steam	83,000	36,000	.....	.....	.....	.....	.....
	IC	25,400	.....	.....	.....	.....	.....	.....
	Total	108,400	36,000	.....	.....	.....	.....	.....
East River Electric Power Coop	Steam	.....	.....	.....	.....	44,000	75,000	119,000
Eastern Iowa Light & Power Coop	Steam	22,000	22,000	.....	.....	.....	.....	.....

West North Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Minnkota Power Coop..	Hydro	600	.....	.....	.....	.....	.....	.....
	Steam	21,500	.....	.....	.....	.....	.....	.....
	IC	22,635	2,272	.....	.....	2,000	2,000	4,000
	Total	44,735	2,272	.....	.....	2,000	2,000	4,000
Northeast Missouri Elect Power Coop	Steam	15,000	.....	.....	.....	.....	11,000	11,000
	IC	7,400	.....	.....	.....	.....	.....	.....
	Total	22,400	.....	.....	.....	.....	11,000	11,000
Rushmore Electric Power Coop	Steam	26,500	.....	.....	.....	.....	44,000	44,000
Sho-Me Power Corp...	Hydro	3,000	.....	.....	.....	.....	.....	.....
	Steam	30,000	30,000	.....	.....	.....	.....	.....
	Total	33,000	30,000	.....	.....	.....	.....	.....
Wheatland Elect Coop.	Steam	17,500	.....	.....	13,500	.....	.....	13,500
	IC	13,700	.....	.....	.....	.....	.....	.....
	Total	31,200	.....	.....	13,500	.....	.....	13,500
Total	**Hydro**	**3,600**	.....	.....	.....	.....	.....	.....
	Steam	**275,500**	**133,000**	.....	**13,500**	**44,000**	**130,000**	**187,500**
	IC	**69,135**	**2,272**	.....	.....	**2,000**	**2,000**	**4,000**
	Total	**348,235**	**135,272**	.....	**13,500**	**46,000**	**132,000**	**191,500**
Corps of Engineers....	Hydro	820,000	160,000	.....	170,000	255,000	638,000	1,063,000
Total	**Hydro**	**820,000**	**160,000**	.....	**170,000**	**255,000**	**638,000**	**1,063,000**
West North Central Total All Agencies...	**Hydro**	**1,453,368**	**160,000**	**4,200**	**170,000**	**606,500**	**641,450**	**1,422,150**
	Steam	**8,980,924**	**849,500**	**879,000**	**468,500**	**309,000**	**2,013,500**	**3,670,000**
	IC	**432,124**	**39,185**	**20,000**	**9,650**	**16,200**	**24,350**	**70,200**
	Total	**10,866,416**	**1,048,685**	**903,200**	**648,150**	**931,700**	**2,679,300**	**5,162,350**

SOUTH ATLANTIC

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Appalachian Power	Hydro	120,705	.....	.....	200,000	240,000	.....	440,000
	Steam	1,982,011	.....	225,000	.....	.....	.....	225,000
	Total	2,102,716	.....	225,000	200,000	240,000	.....	665,000
Baltimore G & E...	Steam	1,089,500	.....	191,000	.....	191,000	.....	382,000
Carolina P & L....	Hydro	209,000	22,000	.....	.....	.....	.....	.....
	Steam	1,179,000	185,000	.....	235,000	.....	.....	235,000
	Total..	1,388,000	207,000	.....	235,000	.....	.....	235,000
Delaware P & L...	Steam	445,000	.....	66,000	.....	150,000	.....	216,000
	IC....	500	.....	.....	.....	.....	.....	.....
	Total	445,500	.....	66,000	.....	150,000	.....	216,000

South Atlantic (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Municipal, State and Power District Systems								
Clewiston, Fla.....	IC	.....	.....	.....	.....	5,000	.....	5,000
Dover, Del.....	Steam	9,500	.....	33,000	.....	.....	.....	33,000
Gainesville, Fla....	Steam	37,650	.....	22,000	.....	.....	33,000	55,000
	IC	1,160	.....	.....	.....	.....	.....	.....
	Total	38,810	.....	22,000	.....	.....	33,000	55,000
Hagerstown, Md...	Steam	31,300	12,500	.....	.....	.....	.....	.....
	IC	1,000	.....	.....	.....	.....	.....	.....
	Total	32,300	12,500	.....	.....	.....	.....	.....
Homestead, Fla....	IC	13,000	.....	.....	3,000	.....	.....	3,000
Jacksonville, Fla....	Steam	413,000	.....	141,120	.....	.....	.....	141,120
Key West, Fla.....	Steam	26,500	.....	.....	16,500	.....	.....	16,500
	IC	6,000	.....	.....	.....	.....	.....	.....
	Total	32,500	.....	.....	16,500	.....	.....	16,500
Kissimmee, Fla.....	IC	7,940	3,000	.....	.....	.....	.....	.....
Lake Worth, Fla...	Steam	7,500	7,500	.....	.....	.....	.....	.....
	IC	16,200	.....	.....	.....	.....	.....	.....
	Total	23,700	7,500	.....	.....	.....	.....	.....
Lakeland, Fla.....	Steam	82,500	25,000	.....	.....	44,000	.....	44,000
Moncks Corner, S. C.	Hydro	134,535	.....	.....	.....	.....	.....	.....
	Steam	88,000	.....	.....	.....	.....	150,000	150,000
	Total	222,535	.....	.....	.....	.....	150,000	150,000
Orlando, Fla.....	Steam	190,000	86,500	.....	.....	100,000	.....	100,000
	IC	33,000	.....	.....	.....	.....	.....	.....
	Total	223,000	86,500	.....	.....	100,000	.....	100,000
Tallahassee, Fla....	Steam	95,000	23,500	.....	.....	.....	.....	.....
Total	**Hydro**	**134,535**	.....	.....	.....	.....	.....	.....
	Steam	**980,950**	**155,000**	**196,120**	**16,500**	**144,000**	**183,000**	**539,620**
	IC	**78,300**	**3,000**	.....	**3,000**	**5,000**	.....	**8,000**
	Total	**1,193,785**	**158,000**	**196,120**	**19,500**	**149,000**	**183,000**	**547,620**
Federal Agencies								
Corps of Engineers.	Hydro	688,000	.....	.....	132,000	132,000	66,000	330,000
Total	**Hydro**	**688,000**	.....	.....	**132,000**	**132,000**	**66,000**	**330,020**
South Atlantic....	**Hydro**	**2,332,020**	**22,000**	.....	**361,600**	**834,500**	**66,000**	**1,262,100**
Total All Agencies	**Steam**	**19,600,936**	**2,046,700**	**1,429,820**	**1,301,500**	**1,420,000**	**2,597,500**	**6,748,820**
	IC	**93,030**	**3,000**	**24,300**	**3,000**	**27,300**	.....	**54,600**
	Total	**22,025,986**	**2,071,700**	**1,454,120**	**1,666,100**	**2,281,800**	**2,663,500**	**8,065,520**

South Atlantic (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Duke Power	Hydro	492,600	.....	.....	.....	262,500	.....	262,500
	Steam	2,793,390	260,700	260,700	.....	.....	339,500	600,200
	Total	3,285,990	260,700	260,700	.....	262,500	339,500	862,700
Eastern Shore Public Service Co of Maryland	Steam	100,000	.....	.....	.....	.....	100,000	100,000
Florida Power	Hydro	10,400	.....	.....	.....	.....	.....	.....
	Steam	796,000	.....	125,000	.....	200,000	.....	325,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	809,400	.....	125,000	.....	200,000	.....	325,000
Florida P & L	Steam	1,883,000	240,000	240,000	300,000	300,000	350,000	1,190,000
	IC	6,000	.....	.....	.....	.....	.....	.....
	Total	1,889,000	240,000	240,000	300,000	300,000	350,000	1,190,000
Florida Public Utilities	Hydro	170	.....	.....	.....	.....	.....	.....
	Steam	10,770	.....	.....	.....	.....	.....	.....
	IC	.....	.....	2,000	.....	.....	.....	2,000
	Total	10,940	.....	2,000	.....	.....	.....	2,000
Georgia Power	Hydro	410,610	.....	.....	29,600	.....	.....	29,600
	Steam	1,414,000	.....	.....	.....	245,000	875,000	1,120,000
	Total	1,824,610	.....	.....	29,600	245,000	875,000	1,149,600
Gulf Power	Steam	230,000	.....	75,000	.....	.....	125,000	200,000
Monongahela Power	Steam	685,065	178,000	.....	.....	.....	.....	.....
	IC	3,880	.....	.....	.....	.....	.....	.....
	Total	688,945	178,000	.....	.....	.....	.....	.....
Ohio Power	Steam	*1,155,000	500,000	.....	.....	.....	500,000	500,000
		*Does not include 1,644,322 kw in State of Ohio.						
Potomac Electric Power	Steam	1,351,000	185,000	.....	185,000	.....	.....	185,000
Savannah Electric & Power	Steam	170,850	.....	51,000	.....	.....	.....	51,000
South Carolina E & G	Hydro	161,000	.....	.....	.....	.....	.....	.....
	Steam	729,000	.....	.....	125,000	.....	125,000	250,000
	IC	150	.....	22,300	.....	22,300	.....	44,600
	Total	890,150	.....	22,300	125,000	22,300	125,000	294,600
Tampa Electric	Steam	735,000	175,000	.....	.....	190,000	.....	190,000
Virginia Electric & Power	Hydro	105,000	.....	.....	.....	200,000	.....	200,000
	Steam	1,871,400	168,000	.....	440,000	.....	.....	440,000
	IC	1,200	.....	.....	.....	.....	.....	.....
	Total	1,977,600	168,000	.....	440,000	200,000	.....	640,000
Total	**Hydro**	**1,509,485**	**22,000**	.....	**229,600**	**702,500**	.....	**932,100**
	Steam	**18,619,986**	**1,891,700**	**1,233,700**	**1,285,000**	**1,276,000**	**2,414,500**	**6,209,200**
	IC	**14,730**	.....	**24,300**	.....	**22,300**	.....	**46,600**
	Total	**20,144,201**	**1,913,700**	**1,258,000**	**1,514,600**	**2,000,800**	**2,414,500**	**7,187,900**

EAST SOUTH CENTRAL

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Alabama Power	Hydro	489,700	.....	137,250	108,000	45,000	337,700	627,950
	Steam	1,436,250	.....	.....	.....	.....	600,000	600,000
	Total	1.925,950	.....	137,250	108,000	45,000	937,700	1,227,950
Kentucky Power	Steam	.....	.....	265,000	.....	.....	.....	265,000
Kentucky Utilities	Hydro	24,000	.....	.....	.....	.....	.....	.....
	Steam	551,000	.....	.....	.....	150,000	.....	150,000
	Total	575,000	.....	.....	.....	150,000	.....	150,000
Louisville G & E	Hydro	80,320	.....	.....	.....	.....	.....	.....
	Steam	740,000	.....	.....	156,250	.....	.....	156,250
	Total	820,320	.....	.....	156,250	.....	.....	156,250
Mississippi Power	Steam	297,500	75,000	.....	112,000	.....	.....	112,000
Mississippi P & L	Steam	683,000	.....	.....	.....	.....	150,000	150,000
	IC	3,000	.....	.....	.....	.....	.....	.....
	Total	686,000	.....	.....	.....	.....	150,000	150,000
Southern Electric Generating	Steam	500,000	500,000	250,000	250,000	.....	.....	500,000
Total	**Hydro**	**594,020**	.....	**137,250**	**108,000**	**45,000**	**337,700**	**627,950**
	Steam	**4,207,750**	**575,000**	**515,000**	**518,250**	**150,000**	**750,000**	**1,933,250**
	IC	**3,000**	.....	.....	.....	.....	.....	.....
	Total	**4,804,770**	**575,000**	**652,250**	**626,250**	**195,000**	**1,087,700**	**2,561,200**
Municipal, State and Power District Systems								
Clarksdale, Miss	Steam	24,000	.....	9,500	.....	.....	.....	9,500
Greenwood, Miss	Steam	39,000	12,500	.....	.....	16,500	.....	16,500
Yazoo City, Miss	Steam	20,000	.....	.....	.....	.....	16,500	16,500
Total	**Steam**	**83,000**	**12,500**	**9,500**	.....	**16,500**	**16,500**	**42,500**
Cooperatives								
Alabama Electric Coop	Hydro	8,700	.....	.....	.....	.....	.....	.....
	Steam	47,000	.....	.....	.....	50,000	.....	50,000
	IC	1,200	.....	.....	.....	.....	.....	.....
	Total	56,900	.....	.....	.....	50,000	.....	50,000
East Kentucky Rural Elect. Coop	Steam	192,000	72,000	.....	.....	.....	100,000	100,000
Total	**Hydro**	**8,700**	.....	.....	.....	.....	.....	.....
	Steam	**239,000**	**72,000**	.....	.....	**50,000**	**100,000**	**150,000**
	IC	**1,200**	.....	.....	.....	.....	.....	.....
	Total	**248,900**	**72,000**	.....	.....	**50,000**	**100,000**	**150,000**

East South Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Federal Agencies								
Corps of Engineers	Hydro	607,000	.....	.....	65,000	65,000	130,000	260,000
Tennessee Valley Authority	Hydro	3,144,400	24,000	108,000	151,200	72,000	.....	331,200
	Steam	8,739,000	475,000	.....	1,190,000	1,190,000	800,000	3,180,000
	Total	11,883,400	499,000	108,000	1,341,200	1,262,000	800,000	3,511,200
Total	**Hydro**	**3,751,400**	**24,000**	**108,000**	**216,200**	**137,000**	**130,000**	**591,200**
	Steam	**8,739,000**	**475,000**	.....	**1,190,000**	**1,190,000**	**800,000**	**3,180,000**
	Total	**12,490,400**	**499,000**	**108,000**	**1,406,200**	**1,327,000**	**930,000**	**3,771,200**
East South Central	**Hydro**	**4,354,120**	**24,000**	**245,250**	**324,200**	**182,000**	**467,700**	**1,219,150**
Total All Agencies	**Steam**	**13,268,750**	**1,134,500**	**524,500**	**1,708,250**	**1,406,500**	**1,666,500**	**5,305,750**
	IC	**4,200**	.....	.....	.....	.....	.....	.....
	Total	**17,627,070**	**1,158,500**	**769,750**	**2,032,450**	**1,588,500**	**2,134,200**	**6,524,900**

WEST SOUTH CENTRAL

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Arkansas P & L	Hydro	65,300	.....	.....	.....	.....	.....	.....
	Steam	708,750	.....	325,000	.....	.....	.....	325,000
	Total	774,050	.....	325,000	.....	.....	.....	325,000
Central Louisiana Electric	Steam	173,750	.....	100,000	.....	.....	.....	100,000
	IC	14,758	.....	.....	.....	.....	.....	.....
	Total	188,508	.....	100,000	.....	.....	.....	100,000
Central P & L	Hydro	10,000	.....	.....	.....	.....	.....	.....
	Steam	876,800	110,000	.....	.....	175,000	.....	175,000
	Total	886,800	110,000	.....	.....	175,000	.....	175,000
Dallas P & L	Steam	1,131,000	.....	.....	175,000	.....	.....	175,000
El Paso Electric	Steam	350,000	90,000	.....	.....	90,000	.....	90,000
Gulf States Utilities	Steam	1,501,000	324,000	.....	220,000	220,000	660,000	1,100,000
Houston Lighting & Power	Steam	2,502,250	439,000	275,000	.....	.....	350,000	625,000
Louisiana P & L	Steam	631,750	.....	223,000	.....	.....	230,000	453,000
New Orleans P S	Steam	528,000	.....	.....	.....	227,000	.....	227,000
Oklahoma G & E	Steam	982,496	.....	.....	.....	210,360	.....	210,360
	IC	13,099	.....	.....	.....	24,220	.....	24,220
	Total	995,595	.....	.....	.....	234,580	.....	234,580

West South Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
San Antonio, Texas	Steam	568,635	.....	100,000	.....	165,000	.....	265,000
Stillwater, Okla	Steam	33,500	12,650	.....	.....	.....	22,000	22,000
Tonkawa, Okla	IC	2,340	.....	1,500	.....	.....	.....	1,500
Uinita, Okla	Hydro	86,900	.....	.....	.....	.....	.....	.....
	Steam	45,000	5,000	.....	.....	.....	.....	.....
	Total	131,900	5,000	.....	.....	.....	.....	.....
Welsh, La	IC	1,046	600	.....	.....	.....	.....	.....
Total	**Hydro**	**86,900**	.....	.....	.....	.....	.....	.....
	Steam	**994,785**	**134,150**	**162,000**	.....	**198,000**	**137,000**	**497,000**
	IC	**43,980**	**5,070**	**10,350**	.....	**3,650**	**1,360**	**15,360**
	Total	**1,125,665**	**139,220**	**172,350**	.....	**201,650**	**138,360**	**512,360**
Cooperatives								
Brazos Electric Power Coop	Hydro	53,000	.....	.....	.....	.....	.....	.....
	Steam	56,000	.....	.....	.....	22,000	.....	22,000
	Total	109,000	.....	.....	.....	22,000	.....	22,000
Medina Electric Coop	Steam	.....	.....	66,000	.....	.....	.....	66,000
Total	**Hydro**	**53,000**	.....	.....	.....	.....	.....	.....
	Steam	**56,000**	.....	**66,000**	.....	**22,000**	.....	**88,000**
	Total	**109,000**	.....	**66,000**	.....	**22,000**	.....	**88,000**
Federal Agencies								
Corps of Engineers	Hydro	601,000	.....	190,000	.....	96,000	674,000	960,000
Total	**Hydro**	**601,000**	.....	**190,000**	.....	**96,000**	**674,000**	**960,000**
West South Central	**Hydro**	**816,530**	.....	**190,000**	.....	**96,000**	**674,000**	**960,000**
Total All Agencies	**Steam**	**15,335,181**	**1,565,650**	**1,321,000**	**743,750**	**1,492,360**	**2,168,000**	**5,725,110**
	IC	**135,467**	**7,070**	**10,350**	.....	**27,870**	**1,360**	**39,580**
	Total	**16,287,178**	**1,572,720**	**1,521,350**	**743,750**	**1,616,230**	**2,843,360**	**6,724,690**

MOUNTAIN

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Arizona P S	Hydro	5,100	.....	.....	.....	.....	.....	.....
	Steam	619,000	.....	115,000	.....	350,000	175,000	640,000
	IC	13,400	.....	.....	.....	.....	.....	.....
	Total	637,500	.....	115,000	.....	350,000	175,000	640,000

West South Central (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Totals Addition Now Planned
Public Service Co. of Oklahoma	Steam	792,500	.....	170,000	.....	.....	185,000	355,000
	IC	2,000	2,000	.....	.....	.....	.....	.....
	Total	794,500	2,000	170,000	.....	.....	185,000	355,000
Southwestern Electric Power	Steam	699,000	116,000	.....	.....	.....	186,000	186,000
Southwestern P S....	Hydro	330	.....	.....	.....	.....	.....	.....
	Steam	739,000	112,500	.....	112,500	.....	320,000	432,500
	IC	11,670	.....	.....	.....	.....	.....	.....
	Total	751,000	112,500	.....	112,500	.....	320,000	432,500
Texas Electric Service	Steam	1,369,300	240,000	.....	.....	350,000	.....	350,000
	IC	12,475	.....	.....	.....	.....	.....	.....
	Total	1,381,775	240,000	.....	.....	350,000	.....	350,000
Texas P & L.....	Steam	975,800	.....	.....	156,250	.....	.....	156,250
	IC	15,585	.....	.....	.....	.....	.....	.....
	Total	991,385	.....	.....	156,250	.....	.....	156,250
West Texas Utilities..	Steam	323,000	.....	.....	80,000	.....	100,000	180,000
	IC	21,900	.....	.....	.....	.....	.....	.....
	Total	344,900	.....	.....	80,000	.....	100,000	180,000
Total.....	**Hydro**	**75,630**	.....	.....	.....	.....	.....	.....
	Steam	**14,284,396**	**1,431,500**	**1,093,000**	**743,750**	**1,272,360**	**2,031,000**	**5,140,110**
	IC	**91,487**	**2,000**	.....	.....	**24,220**	.....	**24,220**
	Total	**14,451,513**	**1,433,500**	**1,093,000**	**743,750**	**1,296,580**	**2,031,000**	**5,164,330**
Municipal, State and Power District Systems								
Austin, Texas.....	Steam	250,000	100,000	.....	.....	.....	100,000	100,000
Brady, Texas.....	IC	7,760	2,460	.....	.....	.....	.....	.....
Crosbyton, Texas....	IC	1,945	650	.....	.....	650	.....	650
Garland, Texas.....	Steam	31,500	16,500	16,500	.....	33,000	.....	49,500
	IC	7,500	.....	.....	.....	.....	.....	.....
	Total	39,000	16,500	16,500	.....	33,000	.....	49,500
Greenville, Texas...	IC	.....	.....	4,500	.....	.....	.....	4,500
Jasper, Texas.....	IC	6,360	.....	1,250	.....	.....	.....	1,250
Jonesboro, Ark.....	Steam	31,650	.....	.....	.....	.....	15,000	15,000
Monroe, La.....	Steam	34,500	.....	25,000	.....	.....	.....	25,000
New Orleans, La....	Steam	.....	.....	20,500	.....	.....	.....	20,500
Paragould, Ark.....	IC	4,000	.....	700	.....	.....	.....	700
Piggott, Ark.....	IC	4,129	1,360	.....	.....	.....	1,360	1,360
Robstown, Texas....	IC	8,900	.....	2,400	.....	3,000	.....	5,400

Mountain (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Idaho Power.....	Hydro	706,345	.....	218,000	.....	.....	391,000	609,000
Montana Power.....	Hydro	530,000	.....	.....	.....	.....	100,000	100,000
	Steam	66,000	.....	.....	.....	.....	.....	.....
	Total	596,000	.....	.....	.....	.....	100,000	100,000
Public Service Co of Colorado	Hydro	37,500	.....	.....	.....	.....	.....	.....
	Steam	841,600	48,000	.....	171,000	.....	171,000	342,000
	IC	1,950	.....	.....	.....	.....	.....	.....
	Total	881,050	48,000	.....	171,000	.....	171,000	342,000
Public Service Co of New Mexico	Steam	259,000	50,000	.....	75,000	.....	75,000	150,000
Sierra Pacific Power.....	Hydro	9,700	.....	.....	.....	.....	.....	.....
	Steam	.....	.....	.....	.....	.....	66,000	66,000
	IC	18,000	18,000	18,000	20,000	.....	.....	38,000
	Total	27,700	18,000	18,000	20,000	.....	66,000	104,000
Southern Colorado Power.	Hydro	1,500	.....	.....	.....	.....	.....	.....
	Steam	91,950	.....	.....	.....	44,000	.....	44,000
	Total	93,450	.....	.....	.....	44,000	.....	44,000
Southern Nevada Power..	Hydro	100,000	.....	.....	.....	.....	.....	.....
	Steam	119,000	.....	71,000	.....	.....	70,000	141,000
	Total	219,000	.....	71,000	.....	.....	70,000	141,000
Tucson Gas, El & P.....	Steam	327,100	108,800	.....	106,000	.....	.....	106,000
	IC	13,000	.....	7,500	.....	.....	.....	7,500
	Total	340,100	108,800	7,500	106,000	.....	.....	113,500
Utah P & L.....	Hydro	152,665	.....	.....	.....	.....	.....	00
	Steam	517,600	.....	.....	.....	150,000	350,000	500,000
	IC	3,600	50,000	.....	.....	.....	.....	.....
	Total	673,865	50,000	.....	.....	150,000	350,000	500,000
Western Colorado Power.	Hydro	12,400	.....	.....	.....	.....	.....	.....
	Steam	22,200	.....	.....	.....	.....	12,650	12,650
	Total	34,600	.....	.....	.....	.....	12,650	12,650
Total.....	**Hydro**	**1,555,210**	.....	**218,000**	.....	.....	**491,000**	**709,000**
	Steam	**2,863,450**	**206,800**	**186,000**	**352,000**	**544,000**	**919,650**	**2,001,650**
	IC	**49,950**	**68,000**	**25,500**	**20,000**	.....	.....	**45,500**
	Total	**4,468,610**	**274,800**	**429,500**	**372,000**	**544,000**	**1,410,650**	**2,756,150**
Municipal, State and Power District Systems								
Colorado Springs, Colo...	Hydro	6,000	.....	.....	.....	.....	.....	.....
	Steam	80,000	.....	.....	45,000	.....	.....	45,000
	Total	86,000	.....	.....	45,000	.....	.....	45,000
Farmington, New Mexico.	Steam	33,235	16,500	.....	.....	.....	.....	.....
Fort Collins, Colo.....	Hydro	10,000	1,000	1,000	.....	.....	.....	1,000
	Steam	10,000	.....	.....	.....	.....	.....	.....
	Total	20,000	1,000	1,000	.....	.....	.....	1,000

Mountain (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Totals Addition Now Planned
Lamar, Colo.	Steam	.....	.....	.....	16,500	.....	.....	16,500
Salt River Agricultural Improvement & Power District	Hydro	70,890	.....	.....	.....	.....	.....	.....
	Steam	347,272	.....	163,200	.....	.....	.....	163,200
	IC	10,000	.....	.....	.....	.....	.....	.....
	Total	428,162	.....	163,200	.....	.....	.....	163,200
Raton, N. M.	Steam	6,000	.....	8,000	.....	.....	.....	8,000
Total	**Hydro**	**86,890**	**1,000**	**1,000**	.....	.....	.....	**1,000**
	Steam	**476,507**	**16,500**	**171,200**	**61,500**	.....	.....	**232,700**
	IC	**10,000**	.....	.....	.....	.....	.....	.....
	Total	**573,397**	**17,500**	**172,200**	**61,500**	.....	.....	**233,700**
Cooperatives								
Lea County Elect. Coop.	Steam	.....	.....	16,500	.....	.....	.....	16,500
	IC	20,630	.....	.....	.....	.....	.....	.....
	Total	20,630	.....	16,500	.....	.....	.....	16,500
Plains Electric G & T Coop	Steam	49,500	.....	.....	.....	44,000	.....	44,000
Total	**Steam**	**49,500**	.....	**16,500**	.....	**44,000**	.....	**60,500**
	IC	**20,630**	.....	.....	.....	.....	.....	.....
	Total	**70,130**	.....	**16,500**	.....	**44,000**	.....	**60,500**
Federal Agencies								
Bureau of Reclamation	Hydro	2,524,000	48,000	108,500	.....	108,000	1,324,500	1,541,000
Corps of Engineers	Hydro	127,600	.....	80,000	.....	.....	36,000	116,000
Total	**Hydro**	**2,651,600**	**48,000**	**188,500**	.....	**108,000**	**1,360,500**	**1,657,000**
Mountain	**Hydro**	**4,293,700**	**49,000**	**407,500**	.....	**108,000**	**1,851,500**	**2,367,000**
Total All Agencies	**Steam**	**3,389,457**	**223,300**	**373,700**	**413,500**	**588,000**	**919,650**	**2,294,850**
	IC	**80,580**	**68,000**	**25,500**	**20,000**	.....	.....	**45,500**
	Total	**7,763,737**	**340,300**	**806,700**	**433,500**	**696,000**	**2,771,150**	**4,707,350**

PACIFIC

Power Companies	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
California Electric Power	Hydro	92,300	.....	.....	.....	.....	.....	.....
	Steam	330,200	.....	62,000	.....	.....	.....	62,000
	Total	422,500	.....	62,000	.....	.....	.....	62,000
California Oregon Power	Hydro	411,950	.....	18,000	.....	.....	227,000	245,000
	IC	200	.....	50	.....	.....	.....	50
	Total	412,150	.....	18,050	.....	.....	227,000	245,050

(Pacific (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Pasadena, Calif.	Steam	155,000	.....	.....	.....	.....	50,000	50,000
P.U.D. No. 1 of Chelan County, Wash.	Hydro	260,100	.....	775,000	.....	.....	.....	775,000
Public Utility District #2 of Grant County	Hydro	630,800	473,100	157,700	.....	249,300	581,700	988,700
Sacramento, Calif.	Hydro	.....	.....	66,500	66,500	105,000	.....	238,000
Seattle, Wash.	Hydro	716,000	57,000	.....	.....	.....	600,000	600,000
	Steam	61,000	.....	.....	.....	.....	.....	.....
	Total	777,000	57,000	.....	.....	.....	600,000	600,000
Tacoma, Wash.	Hydro	238,000	.....	.....	120,000	.....	.....	120,000
	Steam	59,000	.....	.....	.....	.....	.....	.....
	Total	297,000	.....	.....	120,000	.....	.....	120,000
Total	**Hydro**	**2,845,900**	**665,100**	**999,200**	**277,000**	**445,200**	**1,944,200**	**3,665,600**
	Steam	**1,770,000**	**44,000**	.....	**230,000**	**230,000**	**138,000**	**598,000**
	Total	**4,615,900**	**709,100**	**999,200**	**507,000**	**675,200**	**2,082,200**	**4,263,600**
Federal Agencies								
Bureau of Reclamation	Hydro	2,644,350	.....	.....	300	384,000	.....	384,300
Corps of Engineers	Hydro	3,894,400	312,000	300,000	25,000	.....	4,408,000	4,733,000
Total	**Hydro**	**6,538,750**	**312,000**	**300,000**	**25,300**	**384,000**	**4,408,000**	**5,117,300**
Pacific	**Hydro**	**14,778,896**	**1,332,500**	**1,317,200**	**444,800**	**829,200**	**7,261,200**	**9,852,400**
Total All Agencies	**Steam**	**10,166,970**	**814,000**	**612,000**	**1,322,000**	**870,000**	**156,500**	**2,960,500**
	IC	**26,100**	.....	**50**	.....	.....	.....	**50**
	Total	**24,971,966**	**2,146,500**	**1,929,250**	**1,766,800**	**1,699,200**	**7,417,700**	**12,812,950**

TOTAL CONTIGUOUS U. S.

Prime Mover	Capacity End of 1960	1960	1961	1962	1963	After 1963	Total Additions New Planned
Hydro	**32,162,180**	**1,595,832**	**3,744,150**	**1,920,600**	**2,656,200**	**11,374,350**	**19,695,300**
Steam	**126,490,373**	**10,781,025**	**8,305,770**	**9,589,000**	**8,077,360**	**13,181,150**	**39,153,280**
IC	**1,097,048**	**149,655**	**171,010**	**67,900**	**78,370**	**60,710**	**377,990**
Total	**159,749,601**	**12,526,512**	**12,220,930**	**11,577,500**	**10,811,930**	**24,616,210**	**59,226,570**

Pacific (continued)

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Pacific G & E.	Hydro	1,977,500	50,000	.....	142,500	.....	436,000	578,500
	Steam	3,630,500	342,000	330,000	330,000	330,000	18,500	1,008,500
	Total	5,608,000	392,000	330,000	472,500	330,000	454,500	1,587,000
Pacific P & L	Hydro	484,426	.....	.....	.....	.....	.....	.....
	Steam	400,470	106,000	.....	.....	.....	.....	.....
	IC	5,900	.....	.....	.....	.....	.....	.....
	Total	890,796	106,000	.....	.....	.....	.....	.....
Portland General Electric	Hydro	331,000	.....	.....	.....	.....	246,000	246,000
	Steam	94,000	.....	.....	.....	.....	.....	.....
	Total	425,000	.....	.....	.....	.....	246,000	246,000
Puget Sound P & L	Hydro	348,900	71,400	.....	.....	.....	.....	.....
	Steam	85,800	.....	.....	.....	.....	.....	.....
	Total	434,700	71,400	.....	.....	.....	.....	.....
San Diego G & E.	Steam	809,000	142,000	.....	142,000	.....	.....	142,000
Southern California Edison	Hydro	1,057,520	150,000	.....	.....	.....	.....	.....
	Steam	3,047,000	180,000	220,000	620,000	310,000	.....	1,150,000
	IC	20,000	.....	.....	.....	.....	.....	.....
	Total	4,124,520	330,000	220,000	620,000	310,000	.....	1,150,000
Washington Water Power	Hydro	690,650	84,000	.....	.....	.....	.....	.....
Total	**Hydro**	**5,394,246**	**355,400**	**18,000**	**142,500**	.....	**909,000**	**1,069,500**
	Steam	**8,396,970**	**770,000**	**612,000**	**1,092,000**	**640,000**	**18,500**	**2,362,500**
	IC	**26,100**	.....	**50**	.....	.....	.....	**50**
	Total	**13,817,316**	**1,125,400**	**630,050**	**1,234,500**	**640,000**	**927,500**	**3,432,050**
Municipal, State and Power District Systems								
Bridgeport, Wash.	Hydro	.....	.....	.....	.....	.....	520,000	520,000
Burbank, Calif.	Steam	114,000	.....	.....	.....	.....	44,000	44,000
Eugene, Ore.	Hydro	24,000	.....	.....	90,500	.....	.....	90,500
	Steam	32,000	.....	.....	.....	.....	.....	.....
	Total	56,000	.....	.....	90,500	.....	.....	90,500
Glendale, Calif.	Steam	104,000	44,000	.....	.....	.....	44,000	44,000
Hetch Hetchy Water Supply & Power Project, Calif	Hydro	205,000	135,000	.....	.....	.....	67,500	67,500
Los Angeles, Calif.	Hydro	737,000	.....	.....	.....	.....	.....	.....
	Steam	1,245,000	.....	.....	230,000	230,000	.....	460,000
	Total	1,982,000	.....	.....	230,000	230,000	.....	460,000
Merced Irrigation District	Hydro	35,000	.....	.....	.....	.....	175,000	175,000
Oroville Wyandotte Irrigation District	Hydro	.....	.....	.....	.....	90,900	.....	90,900

ALASKA AND HAWAII

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Dillingham, Alaska	IC	200	200	1,000	.....	.....	.....	1,000
Ketchikan, Alaska	Hydro	8,200	.....	.....	.....	4,000	.....	4,000
	IC	873	.....	.....	.....	.....	.....	.....
	Total	9,073	.....	.....	.....	4,000	.....	4,000
Hawaiian Electric Co.	Steam	400,000	.....	55,000	.....	82,500	82,500	220,000
Hilo Electric Light Co.	Hydro	3,350	.....	.....	.....	.....	.....	.....
	Steam	23,425	.....	.....	.....	.....	.....	.....
	IC	7,750	.....	2,000	12,000	.....	.....	14,000
	Total	34,525	.....	2,000	12,000	.....	.....	14,000
Maui Electric Co.	Hydro	21,500	.....	.....	.....	.....	.....	.....
	Steam	3,750	3,750	.....	.....	.....	.....	.....
	Total	25,250	3,750	.....	.....	.....	.....	.....
Total	**Hydro**	**33,050**	.....	.....	.....	**4,000**	.....	**4,000**
	Steam	**427,175**	**3,750**	**55,000**	.....	**82,500**	**82,500**	**220,000**
	IC	**8,823**	**200**	**3,000**	**12,000**	.....	.....	**15,000**
	Total	**469,048**	**3,950**	**58,000**	**12,000**	**86,500**	**82,500**	**239,000**

TOTAL UNITED STATES

Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Hydro	**32,195,230**	**1,595,832**	**3,744,150**	**1,920,600**	**2,660,200**	**11,374,350**	**19,699,300**
Steam	**126,917,548**	**10,784,775**	**8,360,770**	**9,589,000**	**8,159,860**	**13,263,650**	**39,373,280**
IC	**1,105,871**	**149,855**	**174,010**	**79,900**	**78,370**	**60,710**	**392,990**
Total	**160,218,649**	**12,530,462**	**12,278,930**	**11,589,500**	**10,898,430**	**24,698,710**	**59,465,570**

U. S. POSSESSIONS

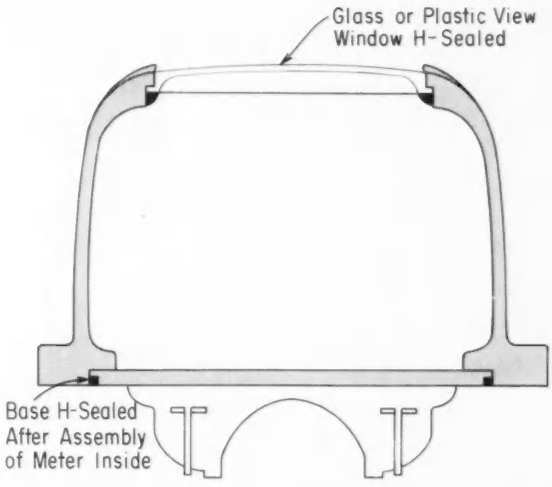
	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Puerto Rico Water Resources Authority	Hydro	107,920	.....	.....	.....	.....	.....	.....
	Steam	343,500	82,500	82,500	82,500	99,000	330,000	594,000
	IC	20,000	20,000	20,000	.....	.....	.....	20,000
	Total	471,420	102,500	102,500	82,500;	99,000	330,000	614,000
Total	**Hydro**	**107,920**	.....	.....	.....	.....	.....	.....
	Steam	**343,500**	**82,500**	**82,500**	**82,500**	**99,000**	**330,000**	**594,000**
	IC	**20,000**	**20,000**	**20,000**	.....	.....	.....	**20,000**
	Total	**471,420**	**102,500**	**102,500**	**82,500**	**99,000**	**330,000**	**614,000**

CANADA

	Prime Mover	Capacity End 1960	1960	1961	1962	1963	After 1963	Total Additions Now Planned
Aluminum Company of Canada	Hydro	3,294,000	330,000	.....	.....	.....	132,000	132,000
British Columbia Electric Co	Hydro	992,700	124,000	.....	.....	.....	.....	.....
	Steam	.....	.....	157,500	157,500	.....	315,000	630,000
	IC	110,379	.....	.....	.....	.....	.....	.....
	Total	1,103,079	124,000	157,500	157,500	.....	315,000	630,000
British Columbia Power Commission	Hydro	303,000	.....	750	.....	48,000	700,000	748,750
	IC	162,000	19,900	5,500	7,500	5,000	.....	18,000
	Total	465,000	19,900	6,250	7,500	53,000	700,000	766,750
Calgary Power Ltd. .	Hydro	320,000	80,000	.....	.....	.....	150,000	150,000
	Steam	144,000	.....	.....	150,000	.....	.....	150,000
	Total	464,000	80,000	.....	150,000	.....	150,000	300,000
Canadian Utilities, Ltd.	Steam	60,000	.....	.....	.....	.....	32,000	32,000
	IC	26,740	.....	28,000	.....	.....	.....	28,000
	Total	86,740	.....	28,000	.....	.....	32,000	60,000
Edmundston, New Brunswick	Hydro	1,100	.....	.....	.....	.....	.....	.....
	IC	3,000	.....	.....	3,000	.....	.....	3,000
	Total	4,100	.....	.....	3,000	.....	.....	3,000
Great Lakes Power Corp	Hydro	175,000	.....	.....	.....	.....	35,000	35,000
Hydro-Electric Power Commission of Ontario	Hydro	4,911,050	.....	.....	.....	.....	.....	.....
	Steam	994,000	378,000	771,000	282,000	282,000	482,000	1,817,000
	IC	1,900	100	.....	.....	.....	.....	.....
	Total	5,906,950	378,100	771,000	282,000	282,000	482,000	1,817,000
Lethbridge, Alberta. .	Steam	13,500	.....	.....	.....	.....	.....	.....
	IC	20,000	.....	10,000	.....	.....	.....	10,000
	Total	33,500	.....	10,000	.....	.....	.....	10,000
Manitoba Hydro-Electric Board	Hydro	420,000	160,000	.....	.....	.....	335,000	335,000
	Steam	120,000	124,000	.....	.....	.....	.....	.....
	Total	540,000	284,000	.....	.....	.....	335,000	335,000
Manitoba Power Commission	IC	5,400	1,000	.....	.....	.....	.....	.....
Maritime Electric Co.	Steam	35,321	10,000	.....	.....	.....	.....	.....
Medicine Hat, Alberta	Steam	42,500	.....	.....	.....	.....	.....	.....
	IC	.....	.....	.....	.....	.....	20,000	20,000
	Total	42,500	.....	.....	.....	.....	20,000	20,000
New Brunswick Electrical Power Commission	Hydro	160,200	.....	.....	41,000	.....	.....	41,000
	Steam	103,800	.....	50,000	.....	.....	75,000	125,000
	IC	1,025	.....	.....	.....	.....	.....	.....
	Total	265,025	.....	50,000	41,000	.....	75,000	166,000
Newfoundland Light & Power Co	Hydro	53,000	.....	.....	.....	8,000	.....	8,000
	Steam	30,000	.....	.....	.....	.....	.....	.....
	IC	2,500	.....	.....	.....	3,000	.....	3,000
	Total	85,500	.....	.....	.....	11,000	.....	11,000
Northern British Columbian Power Co	Hydro	8,400	4,800	.....	.....	.....	.....	.....
	IC	6,400	.....	.....	2,000	.....	.....	2,000
	Total	14,800	4,800	.....	2,000	.....	.....	2,000
Northern Canada Power Commission	Hydro	30,340	7,000	.....	.....	.....	.....	.....
	Steam	600	.....	.....	.....	.....	.....	.....
	IC	8,085	4,410	1,100	.....	.....	.....	1,100
	Total	39,025	11,410	1,100	.....	.....	.....	1,100
Nova Scotia Light & Power Co	Hydro	41,320	.....	.....	.....	5,600	5,000	10,600
	Steam	170,000	.....	.....	.....	.....	.....	.....
	IC	1,920	.....	.....	.....	.....	.....	.....
	Total	213,240	.....	.....	.....	5,600	5,000	10,600
Nova Scotia Power Commission	Hydro	95,000	15,000	.....	.....	.....	.....	.....
	Steam	60,000	20,000	.....	.....	.....	.....	.....
	IC	620	.....	.....	.....	.....	.....	.....
	Total	155,620	35,000	.....	.....	.....	.....	.....
Quebec Hydro-Electric Commission	Hydro	2,984,000	275,000	.....	135,000	495,000	4,500,000	5,130,000
	IC	36,000	36,000	.....	.....	.....	.....	.....
	Total	3,020,000	311,000	.....	135,000	495,000	4,500,000	5,130,000
Regina, Saskatchewan	Steam	85,000	.....	.....	.....	.....	.....	.....
	IC	20,000	20,000	.....	.....	.....	.....	.....
	Total	105,000	20,000	.....	.....	.....	.....	.....
Saskatchewan, Power Corp	Hydro	.....	.....	.....	.....	134,000	254,500	388,500
	Steam	464,000	66,000	.....	.....	.....	.....	.....
	IC	41,500	.....	.....	.....	.....	.....	.....
	Total	505,500	66,000	.....	.....	134,000	254,500	388,500
Shawinigan Water & Power Co	Hydro	1,316,300	.....	.....	.....	.....	310,000	310,000
Total	**Hydro**	**15,105,410**	**995,800**	**750**	**176,000**	**690,600**	**6,421,500**	**7,288,850**
	Steam	**2,322,721**	**598,000**	**978,500**	**589,500**	**282,000**	**904,000**	**2,754,000**
	IC	**447,469**	**81,410**	**44,600**	**12,500**	**8,000**	**20,000**	**85,100**
	Total	**17,875,600**	**1,675,210**	**1,023,850**	**778,000**	**980,600**	**7,345,500**	**10,127,950**

Hermetic Seal to Save Meter Repairs

W. H. FARRINGTON, Staff Meter Engineer, Texas Electric Service Co, Fort Worth, Texas



Hermetic sealing may hold the key to the elimination of repairing and greatly reduce testing of watthour meters. The potential value of a completely-sealed meter is indicated by the results of a Texas Electric Service Co study of the causes of trouble or failures in single-phase meters. Nearly 88% of the troubles are attributable to the ingress of dust, moisture, insects, or other foreign matter.

All of these troubles, and subsequent repairs, would have been eliminated by using hermetically-sealed meters. This conclusion is based on an analysis (shown in the table) of the condition of socket-type, single-phase watthour meters removed from service and processed in the company's meter shops during one month in 1960.

A completely-sealed design seems practicable today because the industry has reached the point where meters can be manufactured and placed in service without repairs or adjustments over their service life. These meters could very well be sealed in a completely-molded case which has a heavy, protected glass or transparent plastic over the dial to permit reading. Selection of a cover material with a high impact strength would help keep in service a significant number of today's meters which suffer cracked or broken glass covers.

In going to a hermetically-sealed meter, the industry should also work to incorporate these additional improvements in the new design:

1. Eliminate all internal screws, bolts or fastenings that could possibly cause trouble.
2. Eliminate adjustments for calibration and bearings.
3. Frames, registers, stators and magnets should be welded, riveted or molded.

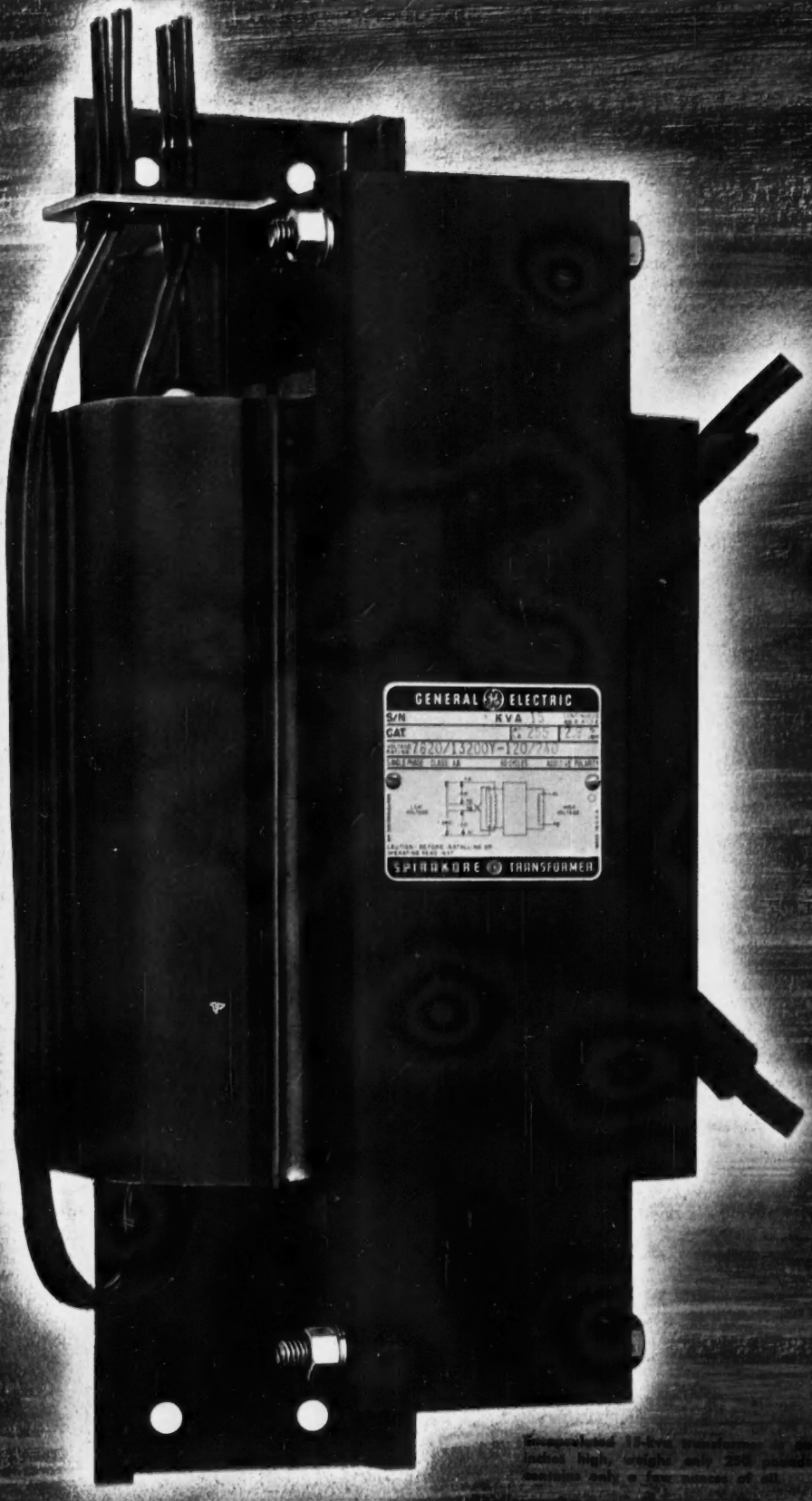
A sealed meter incorporating these features could easily eliminate the need for repairing; repairing of such meters would probably be uneconomical. However, the savings through elimination of repairing and testing would more than compensate for the small number of hermetically-sealed meters that might have to be retired due to troubles correctable in today's gasket-cover meters.

Analysis of 1,742 Meters Removed from Service
(Single-phase, Socket Type)

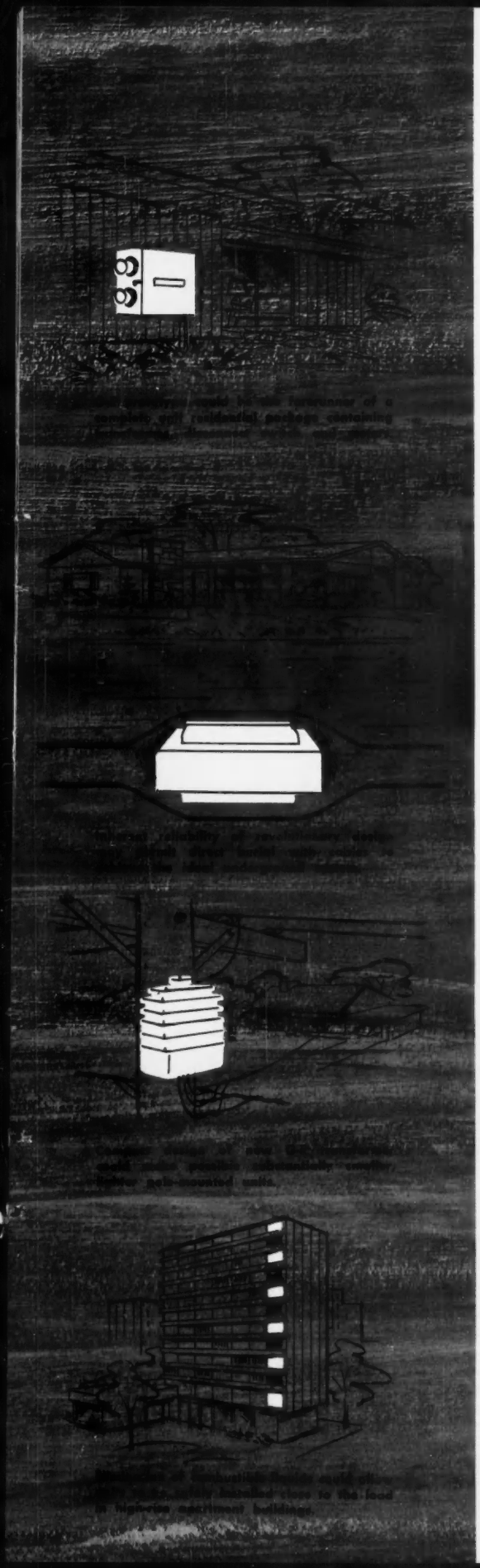
		Percent Needing Repair
Found in Good Condition	304	0.0%
Troubles Preventable by Hermetic Seal		
Bad Gasket	1	
Water Damage	3	
Foreign Matter in Meter	849	
Rust in Meter	196	
*Damaged or Cracked Cover	204	
Subtotal	**1,253**	**87.1%**
Troubles Preventable by New Design Features		
Loose Parts	10	
Broken Insulator Cap in Cover	8	
Damaged Disk or Register	53	
Broken Angle Insulator	61	
Subtotal	**132**	**9.2%**
Troubles Requiring Major Repair		
Lightning or Fire Damage	12	
Damaged Element	2	
Broken Base Plate	18	
Register Friction	21	
Subtotal	**53**	**3.7%**
Total Meters Requiring Repair	**1,438**	**100.0%**

* Damage would not have injured material of high impact strength. Cases of severe damage are not included.

BREAKTHROUGH!



Encapsulated 15-kva transformer is only 10 inches high, weighs only 230 pounds and contains only a few ounces of oil.



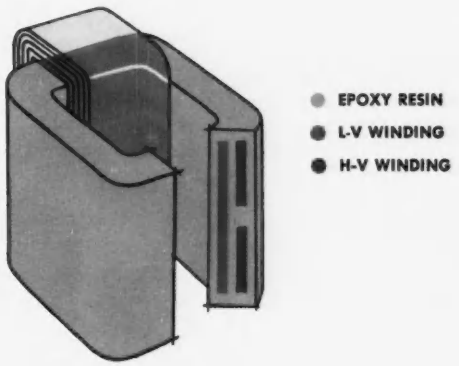
General Electric reports on one of the most important distribution transformer developments in 75 years

Take a close look at *this* distribution transformer . . . it's the first not to use oil for insulation and cooling since Elihu Thomson applied for patent on his oil-filled design in 1886!

It's General Electric's revolutionary new *encapsulated 95-kv BIL transformer*. And though still developmental, it promises important new advantages to help utilities meet the high-load demands of the decade ahead.

The keys to this dramatic innovation are a special epoxy resin and advanced methods of encapsulation that provide high dielectric strength and efficient heat dissipation. Transformer tank, paper layer insulation and all but a thin film of oil around the windings have been eliminated. Result: a distribution transformer 25 percent smaller and significantly lighter than present-day designs—and vastly more versatile. A few of its possible future applications are suggested at the left. There are many more—some as yet undreamed of!

Extensive research and application development are now underway to explore ways in which this important innovation might best be exploited to your full advantage. Such research typifies the unseen *extra* value you get when you specify General Electric—*pioneer of new ideas in power distribution!* General Electric Company, Schenectady 5, N. Y. 482-22



Progress Is Our Most Important Product

GENERAL ELECTRIC

Transformer Load-Loss-Factor Study to Begin

Of paramount importance in determining either the economic changeout point or the most economical loss ratio (copper-to-core) of distribution transformers are the annual load and loss factors at the distribution transformer. In all papers and articles written on the subject, assumptions have to be made and these have varied considerably depending on the author. In addition, as pointed out recently by *Electrical World* ('Transformers Need Re-evaluation,' Feb. 6, p 54), transformer management data obtained directly from a survey of utilities indicate a serious lack of agreement on fundamental operating variables for such installations.

This past week the General Electric Co announced a program designed to find out, as accurately as is now possible, what the annual load and loss factors are at the distribution transformer.

The heart of the GE project is an inexpensive metering kit from which load factor and loss factor can be very quickly and easily calculated. The kit consists of a window-type current transformer, one standard single-phase watthour meter with demand attachment, a newly-developed "current-squared" hour (I^2 hour) demand meter, and the sockets to mount them. The equipment is designed to be installed on the secondary of the distribution transformer being tested—and left in place for a year. The annual load factor can be calculated easily from the watthour demand meter readings and the annual loss factor, from the I^2 hour demand meter readings.

The cooperation of approximately 50 utilities across the country will be solicited. Participation in the program will require, on the part of each utility, a small investment in time and money. Expected gains to be derived are significant.

Specifically, each participating utility will be required to:

- Purchase approximately 12 to 15 metering outfits;
- Install the metering units on the secondary of various sizes of pole-type transformers (determined in consultation with GE);
- Read said meters monthly, for a year.

Forms will be supplied for recording the data so that the exact types of loads being metered will be recorded. Additional forms will also be furnished for each utility to report their monthly readings.

At the end of the year, GE will issue to each participating utility two reports:

1. Results obtained on the participating utility's system.

2. Results obtained by properly weighting and averaging all participating utilities' results.

This program, by producing these reports, should:

- Enable more accurate determination of optimum copper-to-core loss ratio for future designs of "average" distribution transformer;
- Supply data which would make loss evaluation in this part of system more accurate;
- Help participating utilities to determine the economic loading of their own distribution transformers;
- Add to data needed by utility engineers for the design of distribution systems to handle future loads.

The program was set up to provide enough readings to insure a good statistical sampling and average. Any utility may participate. The final results, however, will be weighted to obtain as nearly a country-wide average as possible.

GE LOSS DEMAND METER (bottom) and conventional watthour demand meter comprise kit to be used to determine accurate annual load/loss factors

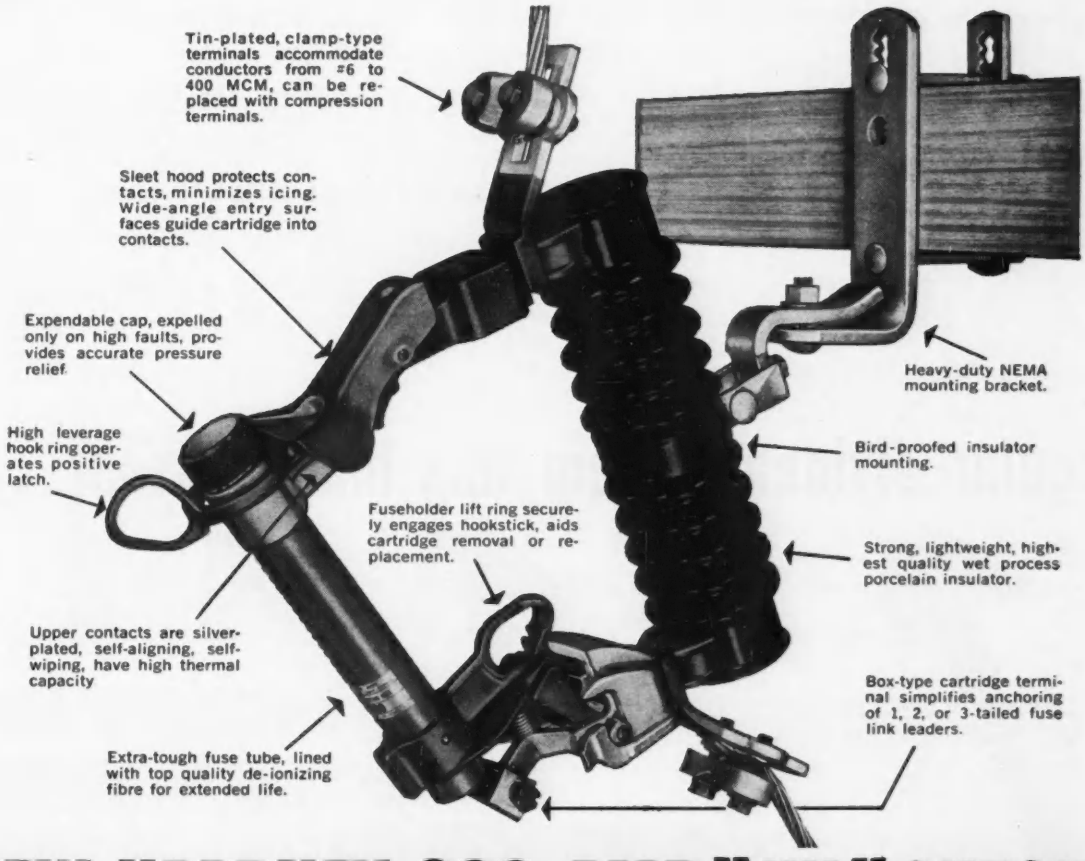
New '65C Rise' Transformers Announced

A series of new pole-type distribution transformers, designed for operation at 65C rise, has been announced by R. E. Uptegraff Manufacturing Co. These units are not 55C transformers re-rated for 65C operation, they say, but are completely new designs in which cyanoethylated paper insulation is applied to meet existing standard ratings of 10, 25, 50, 100 and 167 kva at 65C. Losses in the epoxy-insulated coil wire are reduced to a ratio of about 2.5:1 and total losses at 65C will be "about the same" as those of conventional units at 55C. Voltage drop is reduced, allowing more room for growth.

The new U-65 transformers are more compact than previous units of similar ratings and require less copper, steel, oil and other materials. Consequently, they are easier to handle, store, and install. And their lower manufacturing cost permits a reduced selling price.

The new units are in pilot production at Uptegraff's new Somerset, Pa., plant, looking toward assembly line production by May 1. They will be distinguished by their fluidized-bed-coated covers and a red band on the sidewall.

(*More News of Manufacturers, p* 112)


Tin-plated, clamp-type terminals accommodate conductors from #6 to 400 MCM, can be replaced with compression terminals.
Sleet hood protects contacts, minimizes icing. Wide-angle entry surfaces guide cartridge into contacts.
Expendable cap, expelled only on high faults, provides accurate pressure relief.
High leverage hook ring operates positive latch.
Upper contacts are silver-plated, self-aligning, self-wiping, have high thermal capacity
Extra-tough fuse tube, lined with top quality de-ionizing fibre for extended life.
Fuseholder lift ring securely engages hookstick, aids cartridge removal or replacement.
Heavy-duty NEMA mounting bracket.
Bird-proofed insulator mounting.
Strong, lightweight, highest quality wet process porcelain insulator.
Box-type cartridge terminal simplifies anchoring of 1, 2, or 3-tailed fuse link leaders.

NEW KEARNEY 200 AMP "HX" CUTOUT

Kearney substation-proved to positively and repeatedly interrupt 12,000 amperes at 7.8 KV . . . 10,000 amperes at 15 KV

- No "blind" spots . . . a highly efficient combination of single end venting and expendable cap double venting insures dependable interruption throughout the entire fault range . . . from low current values to maximum rated capacity of the cutout.
- On low and medium faults, expendable cap remains intact . . . tube vents only at bottom. Controlled spring loading and long travel of lower hinge toggle whips fuse cable out of cartridge to insure positive low current interruption.
- Expendable cap is expelled only on high faults. Resultant double end expulsion in line with fuse tube relieves gas pressure, equalizes interruption shock forces and prevents damage to cutout or bracket.
- Switchstick-operated positive latch prevents accidental cartridge dropout due to vibration, impact, or magnetic forces.
- Strong, durable, non-ferrous construction for long life, optimum performance. All current-carrying parts copper alloy. Silver-plated contacts. Stainless steel pins and springs.
- Fuseholders accept all conventional button-type links.
- Kearney "HX" Fuse Cutouts are available on single insulator, NEMA station-post, or centerbolt insulator mountings; also in 100 ampere continuous ratings.

Ask your Kearney Sales Representative for full information or write for "HX" Cutout Bulletin

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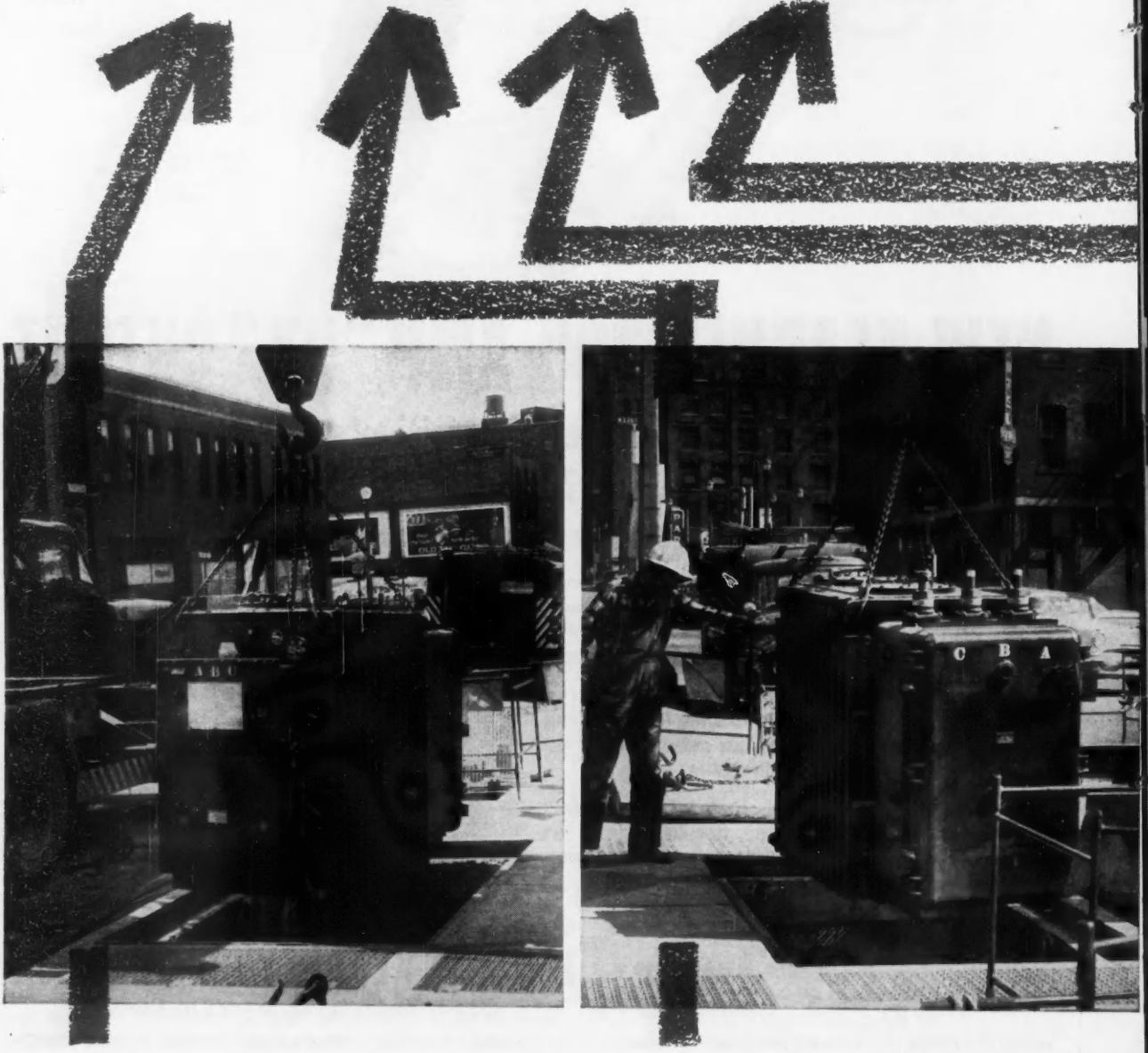
Regular dividends from this hidden asset...



The installation of this rugged, compact Moloney Network Transformer will provide the utility installing it with regular dividends for many years. Moloney thoroughly analyzed network operational problems to develop the advanced design and construction which make this transformer a valuable hidden asset.

Advanced Design Features That Yield Dividends . . .

• Compact size resulting in smaller vaults • Corrugated tank walls to reduce maintenance and facilitate reconditioning • High overload capabilities • Grouped accessories for operational simplicity

Give your system the advantage of this hidden asset . . . Specify Moloney Network Transformers.

MEEC-19

MOLONEY ELECTRIC COMPANY

Transformers for Utilities, Industry, and Electronics

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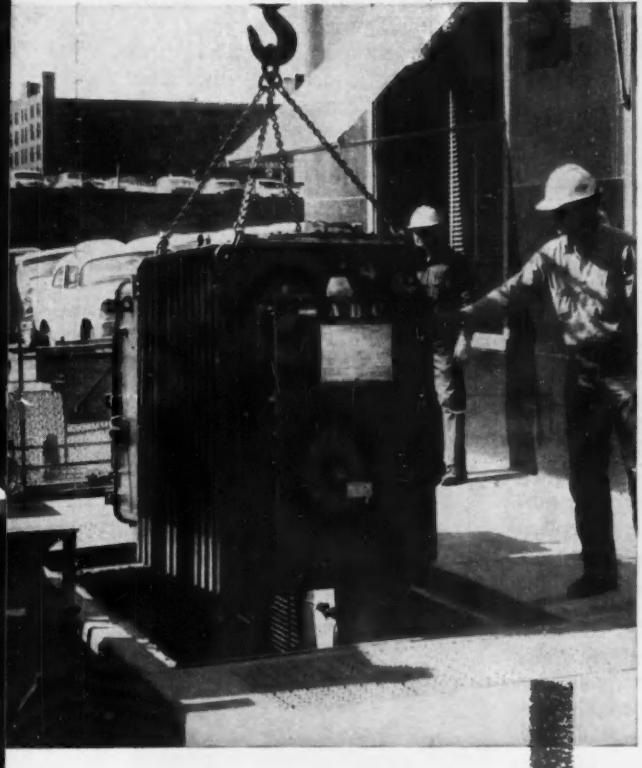
Sales Offices In All Principal Cities



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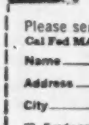

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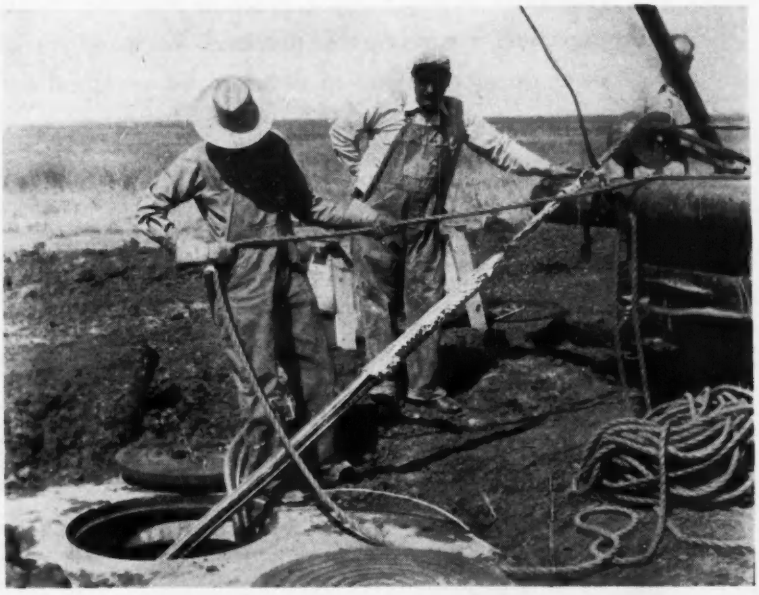


Three Cables Pulled Simultaneously

The recent underground installation of 25,000 ft of 15-kv insulated aluminum cable at Dyess Air Force Base, near Abilene, Tex., is unique on three counts.

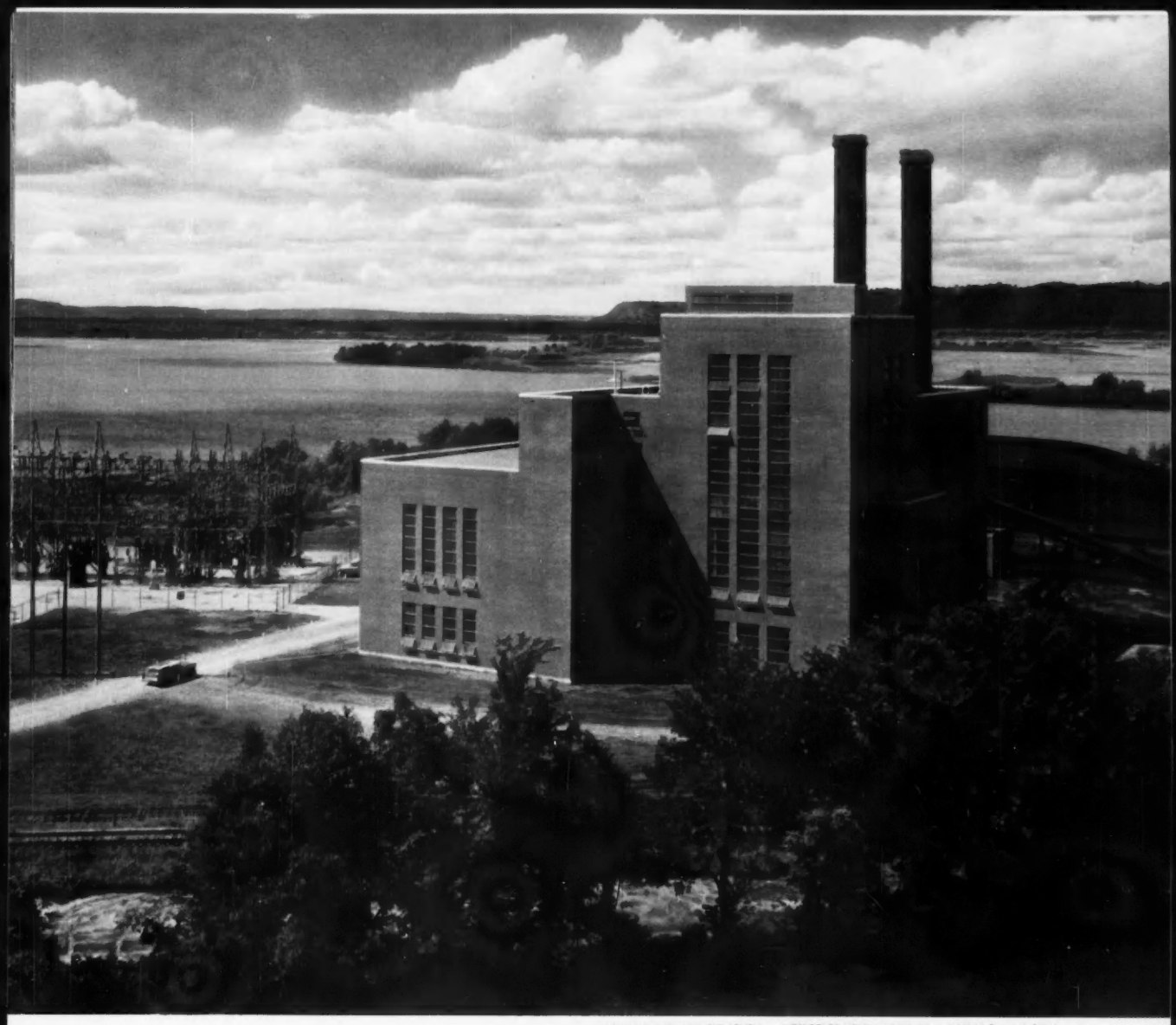
The No. 1 AWG ungrounded neutral cable installation is believed by the supplier, Kaiser Aluminum & Chemical Corp, to be the largest such installation in Texas. It was furnished with three cable lengths paralleled on each reel so they could be pulled simultaneously as demonstrated in the above picture. (Longest runs were 650 ft.) And the installation by Reynolds Electrical & Engineering Co, Inc, required 84 splices to withstand complete water submersion as a safeguard against seasonal drainage problems indigenous to the area.

In addition to easier handling in the pulling operation, use of aluminum provided a substantial savings, says Kaiser. The cable loading was such that the same minimum size aluminum conductor could be used as would have been required if the cable had been copper.

Helicopter Sets Al Dead-End Tower

With the use of a Hiller 12E helicopter, this 115-kv, 1,300-lb, 63-ft-high aluminum tripod dead-end tower, made by Reynolds Metals Co, was installed in only 55 min on Portland General Electric Co's line. Reynolds designed and fabricated the tower with tubular aluminum crossarms to replace a wooden dead-end structure on the utility's Harborton-St. Helens line.

A specially developed W-shaped aluminum extrusion was utilized. Three poles, each containing three of the extrusion sections, were set in a line and connected by a crossbar to form the tower. With guy lines, structure is self-supporting. (*More News of Manufacturers, p* 115)



LANSING POWER STATION INTERSTATE POWER COMPANY *58,000 kw—3 Units*

Power in the Midwest...

10,000 square miles of the richest farm land in the country are served with electric power by Interstate Power Company. Some 14,000 farms in northern Iowa, southern Minnesota, and a portion of northwestern Illinois account for a major share of the utility company's load. Interstate Power Company is helping to build the future of its territory. New additions to the company's system of modern generating plants will continue to supply economic power for further agricultural and industrial development of this growing tri-state region.

FULL COLOR BROCHURE outlining the scope of Sargent & Lundy services will be sent on request.

SARGENT & LUNDY
ENGINEERS

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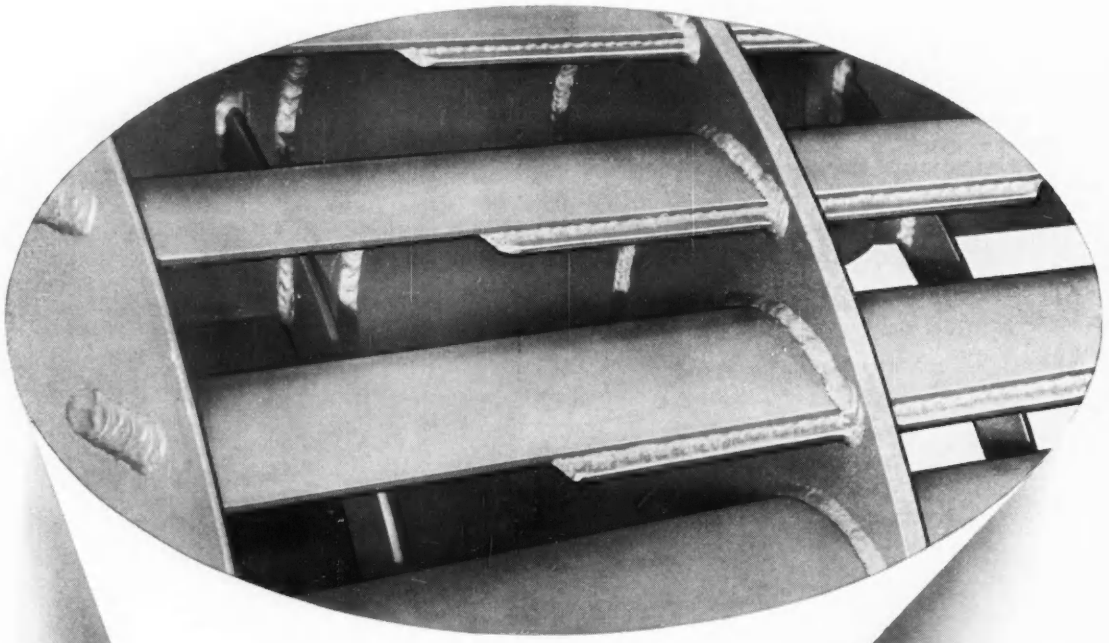


RIGHT

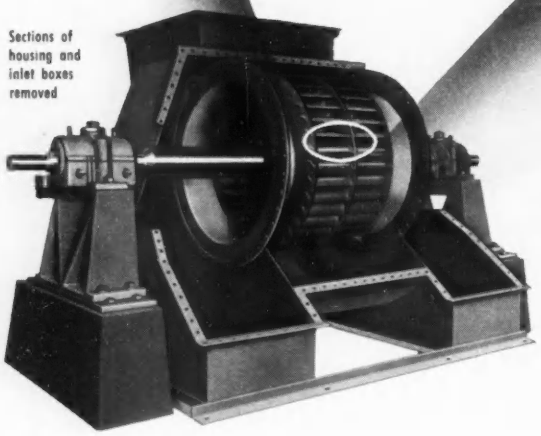
WHERE

THEY

BELONG . . . . . *wearing plates*

on the FACE

of the blades



Sections of housing and inlet boxes removed

Here's another feature you get only from Clarage. The Type DN Dynacurve induced draft fan, when equipped with wearing plates, has these abrasion-resisting steel plates welded to the *face* of the wheel blades.

Result: *extra* service life.

Don't settle for less. Choose the Clarage Dynacurve fan with its rugged wheel of 36 radially deep blades . . . minimum floor space and height requirements . . . bolted scroll liners for easy replacement . . . and numerous other distinctive features.

Contact our nearest office for complete data.

Dependable equipment for making air your servant

CLARAGE FAN COMPANY

Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

MANUFACTURERS BRIEFS

• **Westinghouse Electric Corp** has been awarded a contract to build a 250-Mw turbine-generator unit for West Penn Power Co's Mitchell Station at Courtney, near Monongahela, Pa.

This unit will be a tandem-compound, quadruple-flow machine featuring an inner-cooling system in which hydrogen gas flows through, rather than around generator coils. The unit will be West Penn Power's largest generating unit, also the largest in the Allegheny Power System, and will more than double the plant's capability.

• **Allis-Chalmers Manufacturing Co** will build four large hydraulic turbines for Susquehanna Power Co, if the Federal Power Commission approves the award of the contract. Turbines of vertical, fixed-blade, propeller-type, 85,000 hp under an 86-ft head at 120 rpm are specified for the utility's Conowingo hydroelectric station on the Susquehanna River in Maryland. They will be designed to operate at the same height above the tailwater level and within the same space limitations as A-C's existing lower powered Francis units, realizing approximately 60% additional horsepower with no increase in space.

• **General Electric Co** has predicted that significant investment and efficiency gains can be obtained from combined gas turbine-steam generating plants in the 10 to 50-Mw size range. Large combined-cycle-plants—above 200 Mw—offer fuel economy gains over straight steam plants in the order of 4%, said GE, with such gains to be achieved at little increase in the investment cost per kilowatt of rating. However, GE believes that gains in heat rate or efficiency of the use of fuel for *smaller* combined plants should be even greater than for such larger size combined plants, and expects to offer a 17-Mw combined plant for sale in the near future. Such a plant is well suited to the base load generating requirements of smaller utilities where natural gas is the normal fuel.

The new plants in the smaller size range will be fully integrated, largely standardized units, sold complete by GE.

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This man builds fast, and he builds to last. He works with steel...the proven material for strength, endurance, and adaptability. He works for Ingalls...the proven source for skill, versatility, and economy in steel fabrication and erection. Steel and Ingalls...together they make a great team. Why not get them on your side on your next construction job?

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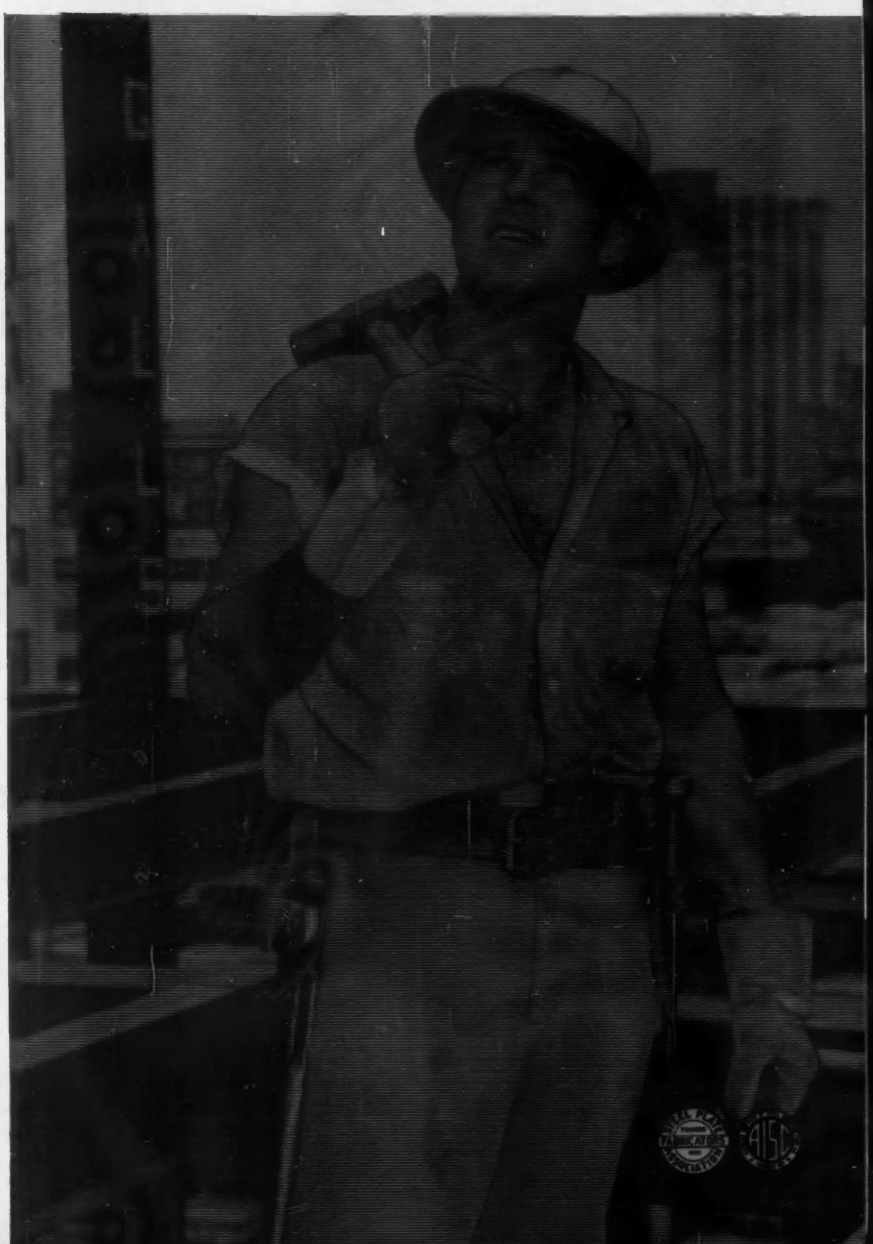


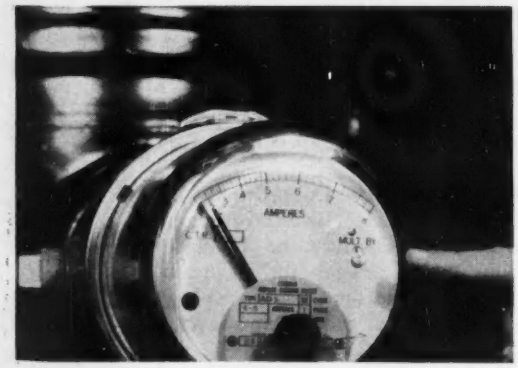
New Equipment

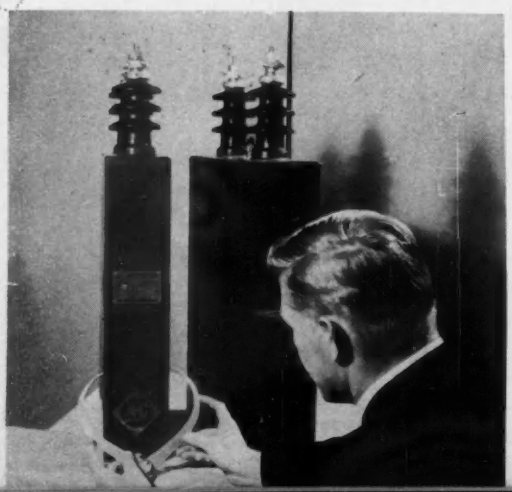
Alarm Indicator . . .

. . . consists of a 25-w radio transmitter with tone-coding device, mounted in a pressurized transformer tank to insure all-weather operation. The tank is covered by a steel hood to prevent tampering. In most installations, the unit operates in conjunction with a recloser and is triggered if a line fault causes the recloser to lock out. When actuated, the transmitter, connected by cable to an antenna on top of the pole, sends out a distinctive tone signal, which is radioed to a radio base station and a digital recorder. Recent rule changes by the Federal Communications Commission permit this type of device to be used to indicate abnormal conditions—as well as to locate line fault. As many as 290 remote alarm indicators may be included in a single system.
Motorola Inc, Communications Div, 4501 W Augusta Blvd, Chicago 51, Ill.

Demand Ammeter . . .

. . . for use on voltage regulator, is dual range, 5-amp meter with an 8-amp scale. New dual-range feature permits high range readings up to 160% load at full scale, as well as low readings up to 80% load at full scale. Accurate readings are provided for loads which may be above or below those for which the regulator is expressly designed. The meter uses the same adapter and socket as previous models. Simple screwdriver adjustment, pointed out in photo, permits scale change.
General Electric Co, Voltage Regulator Product Section, Pittsfield, Mass.





Power Capacitors . . .

. . . have higher insulation levels, although the "low profile" design features lighter weight, narrower models in both 50 kvar and 25 kvar. The 50-kvar, 2,400 through 7,960-v units measure about 25% less in width and are about 23% lighter. The BIL of 6,640 through 7,960 v units is now 95 kv, whereas it was previously 75 kv. In the 2,400 through 4,800-v range, the BIL is now 75 kv, whereas it was formerly 60 kv at 2,400 through 4,160 v. The extended foil construction can withstand higher inrush currents and provides lower current densities at the point of contact.
Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.

Corrosion-resistance of Acco *Aluminized* Wire provides significant economies

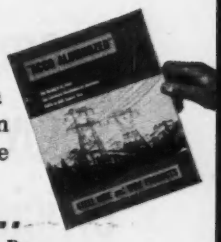
You can minimize losses due to corrosion, through the use of ACCO *Aluminized* strand for guys, messengers, and overhead ground wires, and in ACSR core wire. At PAGE, commercially pure aluminum is bonded to the steel wire by a patented hot-dip method that insures a tight bond of aluminum to steel. You get the strength of the highest quality steel wire combined with the corrosion resistance of commercially pure aluminum.

Millions of feet of aluminized strand and ACSR conductor with aluminized core in service in all parts of the country attest to the superiority of PAGE ACCO *Aluminized* Wire.

Strand • PAGE *Aluminized* Strand meets the physical properties of ASTM Spec. A-122-58 and A-363-58. Available in all sizes and grades.

Core Wire • for ACSR conductor. ACCO *Aluminized* Core Wire meets the requirements of ASTM Spec. 341-59T. In addition to vastly superior corrosion resistance, the danger of electrolytic action is eliminated when you use aluminized core wire.

When you specify PAGE *Aluminized*, you get not only the superior corrosion resistance of aluminum but also the highest quality steel wire—produced by a manufacturer with fifty years experience in the development and manufacture of wire for utility service.



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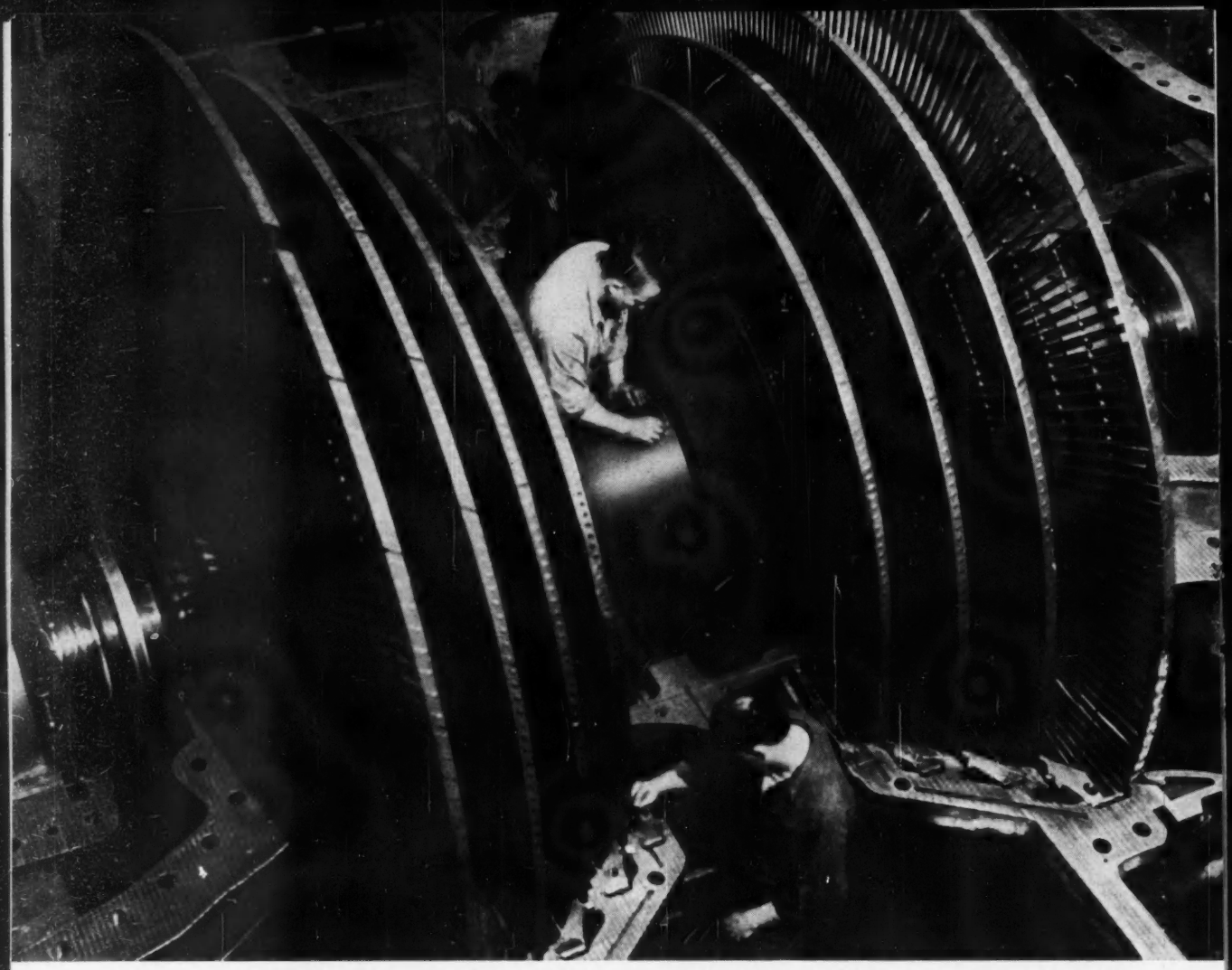

Precision workmanship by skilled craftsmen contributes to the efficiency and reliability of this 90-ton, 1800-rpm, low-pressure steam turbine rotor.

General Electric steam turbine-generators give you increased efficiency and reliability

Three areas where General Electric is continually making progress in improving steam turbine-generator reliability and efficiency are:

Pre-engineered designs—engineered simplicity is the key in these advanced turbine designs, ready now to meet your power generation needs.

Nationwide service program—General Electric's service organization extends right to your neighborhood to give you personalized service by experienced representatives familiar with your particular machines and their place on your system.

Manufacturing breakthrough—with specialized automated machine tools and manufacturing techniques General Electric produces precision components that were unheard of a few years ago. 244-01

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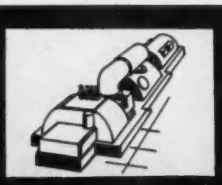
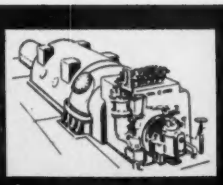
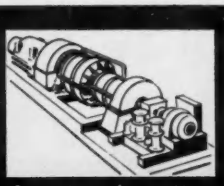
General Electric Turbine-Generators Help Keep Power Costs Low



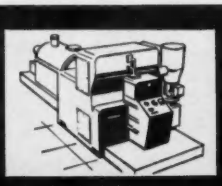
Steam turbine-generators for large blocks of power



Steam turbine-generators 100,000 kw and lower



Gas turbines for peaking, base load, combined cycles

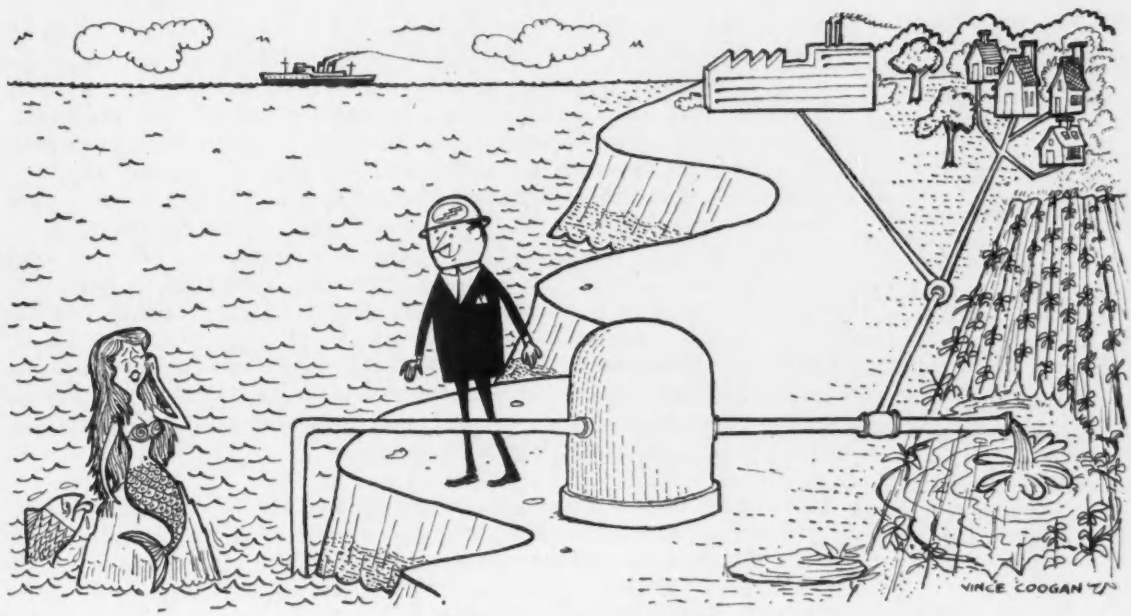


Mechanical drive steam turbines for auxiliaries

Electrical World

FEBRUARY 27, 1961

Management Newsletter



Desalination: New Utility Poser?

Starting as a small ripple of government activity eight years ago, the saline water program of the Department of Interior is giving promise of developing into a healthy flood tide that could have profound effects on the course of many utilities. Like many another "resources development," the program started small. In fact, it was four years before the Congressional headwinds were able to raise the first ripple. That was in 1952, when the Office of Saline Water was set up, with $2 million and five years of life. Today the program has rolled up a $20-million appropriation and is rushing toward another $20 million. And hidden under the rush of support for the program are undercurrents that could affect a host of utility interests, from area development and load building to generation plans and political philosophy.

Why the sudden concern about saline water program? For one thing, political pressure has been building up. President Kennedy, in his State of the Union message, raised the subject twice, commenting that we "have neglected saline water conversion" and claiming that our supply of clear water is diminishing. The Vice President too, is a known supporter who initiated a bill for further development in his Senate days. So did the current Secretary of Interior Stewart Udall. In all, some 13 House bills and three Senate bills were introduced in the last session of Congress to modify or expand the current saline water program. And the comprehensive Johnson bill which would have added $20 million to the OSW program had 21 sponsors. Senate bills introduced in this session have 29 sponsors.

Another factor is the progress made in the past few years, both in commercial projects and at the research level. Although prices of desalted water are still high compared to other water supplies, technical developments have made big cuts possible. Where $1.00 per 1,000 gal was considered an achievement a few years ago, most authorities concede that 75¢ per 1,000 is now attainable and some claim costs in the neighborhood of 50 or even 38¢ per thousand. Finally, there is a significant section of legislators and critics who believe that progress in water conversion will be strong card in the international struggle, since many underdeveloped lands are also critically short of water.

But how competitive would converted water be? Aim of the OSW program is to produce 38¢ water ($125 per acre-ft) for residential use and 12¢ water ($40 per acre-ft) for agriculture. The commonly quoted figure for the average municipal system is about 35¢ per 1,000 gal. Of course, this also includes the cost of the distribution system and other costs, not just the water supply. But desalination proponents argue that most of this plant was built 40 to 50 years ago, at much lower costs; that they were built with bond issues and are being paid off in part with taxes; and that these costs are not figured into the 35¢ cost usually quoted. Moreover, proponents claim that the supplies originally developed were, naturally, the cheapest ones available and that additional supplies today would be much more expensive. One OSW spokesman estimates that capital costs are about 50% of the total water cost, so a more realistic cost for US water would be 60-70¢.

Claims of costs as low as 35¢ per 1,000 gal are made for the flash distillation process if a full-scale plant—50 million gpd—is built. And the $1.00 per thousand expected from the long tube plant in Texas could be cut to 50¢ in an optimum size, 18-million-gpd plant, the OSW man claims.

Where do the electric utilities come into the picture? In its present form, the program cuts across many of their legitimate interests. Even partial success could ease problems of finding water supplies for steam station generation and for area development. In fact, utilities have already done a significant chunk of the pioneering work in this area, including the 150,000-gpd system at Pacific Gas & Electric's Morro Bay plant and the 100,000-150,000-gpd flash distillation unit

(*Continued on page* 122)

OSW Demonstration Plants Test Five Processes for Brackish and Sea Water

Current Processes	Plant Size Gal per Day	Site	Architect & Engineer	Construction Contract	Type of Water	Completion Date
Long-tube vertical multiple distillation	1,000,000	Freeport, Texas	W. L. Badger & Associates	Chicago Bridge & Iron Co	Sea Water	3/61
Multi-stage flash distillation	1,000,000	Point Loma, Calif.	Fluor Corporation	Westinghouse Electric Corp	Sea Water	11/61
Electrodialysis	250,000	Webster, S. D.	Bureau of Reclamation	Asahi Chemical Industries Co	Brackish	8/61
Forced circulation vapor compression distillation	Approximately 1,000,000	Roswell, N. M.	Catalytic Construction Company	Funds requested for Fiscal 1962	Brackish	—
Freezing	150,000-300,000	Wrightsville Beach, N. C.	$100,0000 Appropriated	Funds requested for Fiscal 1962	Sea Water	—

Here's How Some of the Basic Processes Work:

DISTILLATION—Oldest and most familiar of the techniques now being used, these methods use a heat source to vaporize saline water, then cool the distillate back to liquid form, and discard the residual brine. Most of the current efforts use an increased number of states to recapture the latent heat of vaporization and thus improve heat efficiency. The basic process can be used in several ways:

- **Long tube vertical distillation.** Sea water is pumped through a series of evaporators, each under successively lower temperature. Sea water entering the first chamber is evaporated; then condensed and collected in the second chamber, where its heat of vaporization is used to evaporate more sea water for the third chamber. This process is being used in a long-tube vertical design in the OSW 1-million-gpd demonstration plant at Freeport, Texas, with 12 successive stages. A submerged tube system is in use at Pacific Gas & Electric's Morro Bay plant. Since the initial heat supply is reused in each stage, the process has high efficiency but is handicapped by scale formation and corrosion.

- **Multi-stage flash evaporation.** Heated sea water, under pressure, is sprayed into a chamber at lower temperature and pressure. A portion of the heated sea water immediately flashes into vapor, which is then condensed to provide fresh water. The remaining saline water passes into a series of successive chambers, each of which has a slightly higher pressure and thus a lower boiling temperature. Used at Southern California Edison's Mandalay plant to produce 100,000 gpd it will also be used in the OSW's 1-million-gpd plant at Point Loma, Calif.

- **Vapor compression evaporation.** Basically an application of the heat pump, this process boils saline water in an evaporator, then compresses the vapor produced and uses it as the heat supply to boil the solution in the same evaporator. The hot fresh water and brine are passed through heat exchangers where they preheat the incoming saline water feed. The process is considered best adapted for moderate size installations. In a forced circulation form, it is being used at the OSW 250,000-gpd plant in Roswell, N.M. A variation developed by K. C. D. Hickman of the University of Rochester, uses a turbulence to increase heat transfer.

- **Solar distillation.** Intended primarily for tropical or arid regions, this process uses "free" solar energy but has high capital costs. One form uses a tilted glass greenhouse structure which admits about 90% of the sun's rays at normal incidence. Saline water is heated in a black pan. Vaporized water is condensed by the air-cooled glass roof and runs down the under side to collecting troughs.

ELECTRODIALYSIS: In this process, an electric current and ion selective membranes are used to take the salt out of the water. A simple cell consists of a chamber separated into three compartments by two membranes, one passing only negative ions, such as chloride, and one passing only positive ions. The two electrodes are inserted in opposite ends of the cell, each behind one membrane. Saline water is then pumped in. With current passing through the cell, the negative ions migrate to the anode and positive ions to the cathode, leaving the water in the central portion salt-free. Since the power requirements here depend on the salt concentration, this process is most promising for brackish water, but has also been used with low-cost fuel, in the Persian Gulf where salinity of sea water is abnormally high. This process will be used at the OSW's 250,000-gpd plant at Webster, S.D. Smaller units have been under test at Texas Electric Service Co for some years.

FREEZING PROCESSES: A relative newcomer to the field, this approach includes a number of variations. Some form of this process will be used at the OSW demonstration plant in Wrightsville Beach, N.C. One process injects a hydrocarbon which combines with water to form hydrate that freezes a few degrees above zero C. The crystals are then separated from the brine, washed, and then decomposed into an immiscible mixture of water and propane. Another process uses controlled crystallization to produce large ice crystals. A third, using a flash-freeze method, uses in-place regeneration to avoid liquids-solids handling and obtains heat economy by condensing a compressed refrigerant against the melting ice. Firms actively working in this area include Koppers Co, Carrier Corp, Scientific Design, Blaw-Knox and Fairbanks-Morse.

at Southern Cal Edison's Mandalay plant (EW, Sept. 26, 1960, p 66). The latter is reported to be suitable for expansion to several million gpd.

Load building is another area where utility interests are involved. Both the electrodialysis and the freezing processes use significant quantities of electrical energy. Ionics, Inc, a leading proponent of electrodialysis and designer of some 11 domestic and 25 overseas plants, computes an average of about seven kwhr per 1,000 gal of water per 1,000 ppm of solids removed. Thus converting 2,500-ppm brackish water to the 500 ppm considered desirable by the Public Health Service would mean about 14 kwhr per 1,000 gal. And today, water experts estimate that the average American uses some 40 to 50 gpd.

Desalination holds some promise of residential load-building, too. A small home-sized unit, intended to produce 20 gal per day for drinking, cooking, fragile washing and other critical uses, has been developed by American Machine & Foundry Co. Currently under test at Midland, Texas, it is slated for further tests this year in the South and on the West Coast. The unit operates around the clock and uses about as much power as a 60-w bulb. Still another effort in this field are the electrodialysis units that have been used at Texas Electric Service Co for the past six years. Now under test is a unit rated 30,000 gpd, a model for a plant capable of serving a city of 10,000 people. H. R. Drew, director of research at TESCO believes that if further improvements in membranes used can be realized, a large-scale plant operating at a high load factor might produce water at a cost of 30 to 50¢ per 1,000 gal. And with water values rising, many cities in the Southwest may be paying 30¢ or more for new water in a few years, he claims.

Use of nuclear wastes as a heat source is also a possibility. In fact, such a scheme is currently being studied by Chance Vought Aircraft, Inc, under contract with the OSW. The aim is to put the estimated 79 million gal of radioactive liquid wastes now in storage to some practical purpose. The proposal would attempt to calcinate the radioactive wastes into solid powder or pellets which would be used to heat sea water directly without use of intermediate heat exchangers.

Nuclear reactors have been studied, too, as a heat source for such processes. In fact, the Point Loma OSW demonstration plant will obtain heat energy from such a plant. To date, all schemes proposed have used a pressurized water reactor with heavy water moderator and coolant, using a natural uranium dioxide fuel. But some early studies indicate that such water would not be competitive.

But there are other ways—equally, if not more important—in which the program could affect the power utilities. Since many of the processes intended for sea water purification use steam as a heat source, schemes for coupling a power plant to a water plant have been proposed for the last 30 years. In general, these would use high temperature steam to drive the turbines and low temperatures steam to distill water. When demand for power was low, it would be used to drive mechanical converters to increase the yield of water from the original fuel.

And ownership of the steam plant could turn out to be a headache for the investor-owned utilities. One section of sentiment is represented by Cecil B. Ellis in a book entitled "Fresh Water From the Ocean," and sponsored by the Conservation Foundation. "Any large-scale sea water conversion plant," writes Ellis, "would surely be run by some government agency for the good of the people of an entire region. That agency would probably build its own electric power plant. Since this plant would not have to pay taxes or show a profit, it could provide power for sea water conversion at a cost . . . lower than usual commercial rates."

And while any such conversion plant would, in theory, be oriented toward water production, with power production incidental or non-existent, many such "resource development and conservation" projects have, in the past, evolved into new supplies for government-owned power systems.

Over 100 Motors Power Gold Medallion Home

A Gold Medallion home in a quiet residential neighborhood in Ft. Wayne, Ind., has more than 100 fractional-horsepower motors performing many unusual jobs, bringing automation into the home.

Motors lower bunk beds from the wall; they move ashes from the fireplace to the flower bed; and they open and close the draperies covering large glass doors surrounding a central patio.

Motors also vacuum-brush clothes, turn the Christmas tree and even brush teeth, in addition to performing more conventional jobs.

Modern homes have up to 30 motors, many of which the average homeowner is not aware. But in the home of Lisle Hodell, general manager of General Electric Co's general purpose motor department in Ft. Wayne, the average visitor is aware of the many jobs that motors can do in today's house. Motors have become something of a hobby with Hodell, who says, "Now I have a built-in hobby with my home."

In addition to the wide use of motors, this Gold Medallion home utilizes many other electrical devices for greater living comfort. Special fluorescent ballasts permit dimming or brightening of living room lighting. A central built-in vacuum-cleaning system is piped from each room to a utility area where dust is emptied into an incinerator.

All-electric heating is provided by radiant coils in the ceiling and by cables laid below the sliding glass doors and full-length windows around the patio. In the patio pond, a motor-driven pump creates a water fall. Two moraine locust trees are illuminated by spot lights at night. Keeping the patio clean is an easy matter with an outside connection to the cleaning system.

For night-time comfort on the patio, a portable evaporative cooler sprays an aromatic insecticide to repel mosquitoes. A companion device in the flower garden attracts insects with "black" light, whereupon a suction fan pulls them into a disposable plastic bag. Lawn work and gardening also are made easier by motors which power a mower, an edger and a hedge trimmer.

POWERED bunk beds make a bedroom garage at push of a button

A master control panel off the living room enables all lights to be turned off with a button. A sweep-motor in the panel directs a search across all circuits, turning lights off.

The nine-room, two-bath home is occupied by Hodell, his wife and their housekeeper. However, three sets of grandchildren are the reasons for the motor-powered bunk beds. "Push a button and down comes a bed out of the wall," says Hodell. The "kids' room" quickly transforms from an extra bedroom to a playroom, and to a garage. For this latter use, an air-tight door is opened or closed by a button in Hodell's car which activates a motor-driven door operator.

(*More Selling on page* 126)

How Motors Are Used

Kitchen (22): Six major appliances, 11 table appliances, vent fan, curtain motor, deodorizer.

Dining Room (2): Curtain motor, fan.

Library (12): Radio and movie equipment, dictating machine, clock, pencil sharpener, eraser, vibrating chair, shadow box, fan.

Living Room (7): Fireplace (ash removal), coolers, fan, TV control, curtain motors.

Patio (3): Pump, cooler, insect catcher.

Bedroom No. 1 (8): Coolers, exerciser, vibrator, sewing machine, curtain motor, bed vibrators.

Bedroom No. 2 (1): Fan.

Baths (10): Fans, heaters, hair dryer, regrigerator, condenser, shavers, tooth brush.

Hall and Attic (3): Fans.

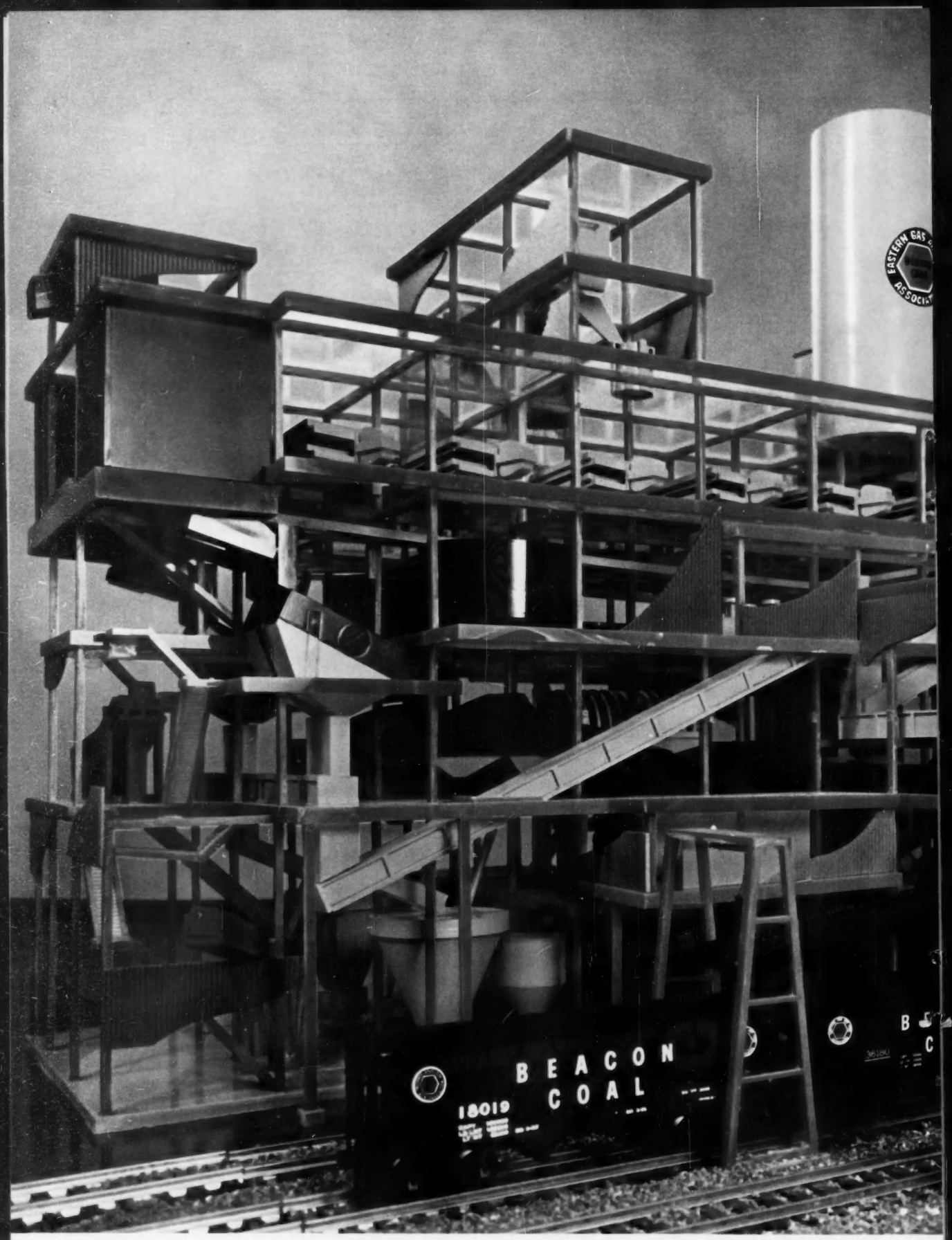
Utility Rooms (8): Central vacuum system, garden equipment, polisher, vacuum cleaner, fan.

Garage (5): Door opener, shoe polisher, record player, bed motors.

Workshop (14): Power tools.

Miscellaneous (8): Powered toys, Christmas tree turner, clothes and hat brushes

GARDEN ashes are moved from fireplace by a motor-powered conveyor



This cutaway scale model shows the tipple construction of our new cleaning plant operation. It is now under construction at our Federal No. 1 mine at Grant Town, West Virginia.

WE ARE BUILDING A NEW CLEANING PLANT

. . . better, cleaner coal will come from this Eastern Gas and Fuel 12,500 tons-per-day new facility

With the completion of the new processing plant at Federal No. 1 mine, we will have the most modern facilities in the Fairmont, West Virginia, coal field. Designed to handle 825 tons-per-hour of raw coal, the new cleaning plant will produce 12,500 tons-per-day of completely cleaned, dried coal in a wide range of sizes.

The plant will be equipped with the most modern machinery for cleaning and sizing the coal. Deister tables, froth cell units and heavy media separation will be used to purify the coal, and several types of dryers and dewatering equipment provide a low moisture content finished product.

Most of the processes within the plant are automatic, including sampling of each size of coal, which provides excellent quality control.

This addition to our facilities reaffirms our faith in the future of coal and our determination to continually improve our product. It underscores, too, a recognition of customer's needs and the ever expanding demand for quality coal. The new plant is now under construction, and is expected to be in full operation in early 1962.

Any Eastern representative will be glad to explain in detail how this new plant can be of service to you. Offices located in Pittsburgh, Boston, Cleveland, Detroit, New York, Norfolk, Philadelphia and Syracuse.

EASTERN GAS AND FUEL ASSOCIATES

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

Must Sell Heating to Double Use by 1970, Women Hear

At least 35% of the new home market must have electric heating if the industry is to approach a doubling of the 1960 average annual kwhr use in 1970.

But older homes—the conversion market—are important too. There are 50 million homes in the United States, many of which have a room or two difficult to heat with the existing heating system, or in which an additional hard-to-heat room is being planned. These represent an immediate market for supplementary electric heat.

There is also the possibility of conversion to total electric heat in the old home.

Thus, George W. Ousler of Edwin L. Wiegand Co and former vice president-sales, Duquesne Light Co, summed up why the industry has to sell the total-electric living concept if it expects to double the average annual residential use in the next ten years. Historical growth is not a valid basis to support a forecast of 7,600 kwhr annual use in 1970, he said.

Ousler made these admonitions at the Fifth Annual Live Better Electrically Women's Conference in Chicago last month.

From the end of World War II to 1954 the residential growth curve had an upward trend, Ousler said. From then on the curve flattened and, in spite of active industry promotion, it gained about 200 kwhr each year for the last six years. Unless this growth line can be extended upward, the industry is headed for only a 50% growth in the next decade, he noted.

Ousler also said that 103,000 electrically heated homes represented only 6.6% of all new homes constructed in 1959, but the 1960 gain of 137,000 electrically heated homes was almost 10.1% of new homes constructed. The forecasted addition of 13.5-15 million new dwelling units in the United States in the next ten years offers an extremely broad potential for electric heating.

Speaking of conversions, Ousler said that of 5,300 electrically heated homes added to the American Electric Power System in 1959, 23% were conversion jobs.

American women, holding in the balance the future of investor-owned utilities, could sign the death warrant for these companies at the same time they are accepting the concept of Live Better Electrically. This seeming paradox, said Dwight C. Van Meter, N. W. Ayer & Son, Inc, could be called "the battle to survive success."

While promoting the LBE concept, investor-owned utilities should bear in mind that:

1. Women out-voted men in the national elections in 1956 and 1958, and were estimated to have done so again last year.

2. Women influence or control 65% of the wealth in this country and set the social and economic standards.

3. They do not hold "the utilities" in high regard, with less than 50% of the women favoring investor ownership of utilities.

Therefore, Van Meter said, while the image or profile of an electric utility is masculine in nature, the residential usage of electricity has a feminine image. Thus investor-owned companies must remake this self-styled masculine image.

Furthermore, more than 33% of the industry's customers think they are being provided electricity by a government agency. The 56% who are informed correctly represent 77% of the men but only 44% of the women.

Van Meter concluded that the "electric women" in the industry have a "Joan of Arc" role in leading management to change the image of their companies in the minds of women customers.

Some of the barriers to selling residential lighting can be broken down if a straightforward approach is used, recommended Edward A. Campbell, manager of the Better Light Better Sight Bureau.

This approach should be:

1. Get the lighting into the home by making it simple but important. The customer will need "X" number of watts of lighting in a particular room to see where he is going or what he is doing.

2. Get the customer to use the lighting. Counter-sell the "turn the lights off" attitude by saying "turn them on and leave them on for the sake of safety, comfort and beauty."

3. Talk to the customers in language they can understand. "Tell them what you would do, tell them why.

"Once you begin talking to the customers in their own language without a lot of double-talk about footcandles and double-jointed diffusing channels then you can add the gilding to the lily," Campbell said.

TELL AND SELL the comforts of electric living with a demonstration model

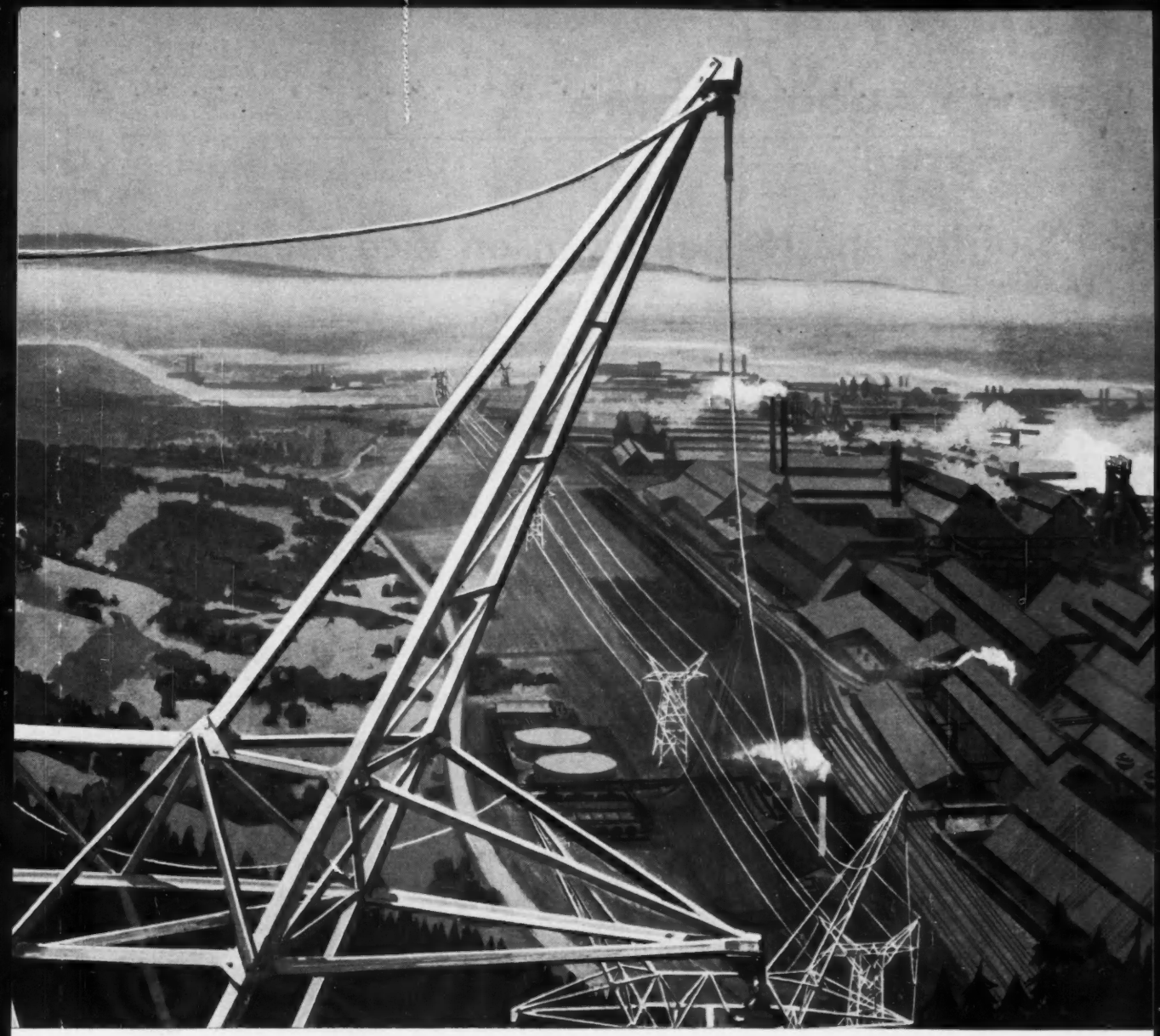
PSE&G Has New Residential Heating Rate

A new rate for residential electric heating which will provide energy at about 1.8¢ per kwhr, where electricity is the "principle source of heating," has been instituted by Public Service Electric & Gas Co.

The utility is also developing a program to promote total-electric homes and individually metered apartments with architects and builders, making use of the new rate.

It is set at $6.00 for the first 200 kwhr, 2.05¢ per kwhr for the next 200, and 1.5¢ for all over 400 kwhr. All are subject to a fuel adjustment clause, currently nearly 0.30¢ per kwhr.

The new rate is estimated to be about 25% under the standard residential rate.



New Bethalume Strand

Combines High Strength of Steel with Corrosion-Protection of Aluminum

Steel

for Strength ... Economy ... Versatility

Bethalume Strand is made of steel wires to which a hot-dip coating of aluminum is carefully applied. It's ideal for use in industrial locations because of its strength and resistance to corrosion. The Bethalume coating, uniform and tightly bonded to the steel, has excellent weathering characteristics.

The Bethalume coating is recommended for messenger and guy strand, and for overhead ground or static wire. For complete information about Bethalume Strand, get in touch with the nearest Bethlehem sales office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

PS of Indiana Names Swanson Vice President

Public Service Co of Indiana, Inc, has elected Dwight H. Swanson vice president. He will be in charge of the southern division, with headquarters in Columbus.

P. A. McLeod, presently southern division manager, will continue in that capacity until his scheduled retirement in June, 1962.

Swanson was assistant to the system planning engineer at Commonwealth Edison Co before coming to PS. He had been with Commonwealth since 1948 in various engineering and operating capacities.

◀ DWIGHT H. SWANSON

Campbell Becomes New President of Canadian Westinghouse

John D. Campbell has been named to succeed George L. Wilcox as president of Canadian Westinghouse Co Ltd. Wilcox became vice president and assistant to the president of Westinghouse Electric Corp (EW, Feb. 6, p 96).

A graduate of Trinity College, Port Hope, Ont., Campbell joined Canadian Westinghouse in 1934 as a member of the time study department. After overseas service during World War II, he returned to the company in 1946. He subsequently held several posts of responsibility with the company and, in 1956, was elected a vice president. Campbell became executive vice president in 1958 and was made a director in 1959.

JOHN D. CAMPBELL ▶

Callahan Elected Senior VP of Sylvania Electric Products

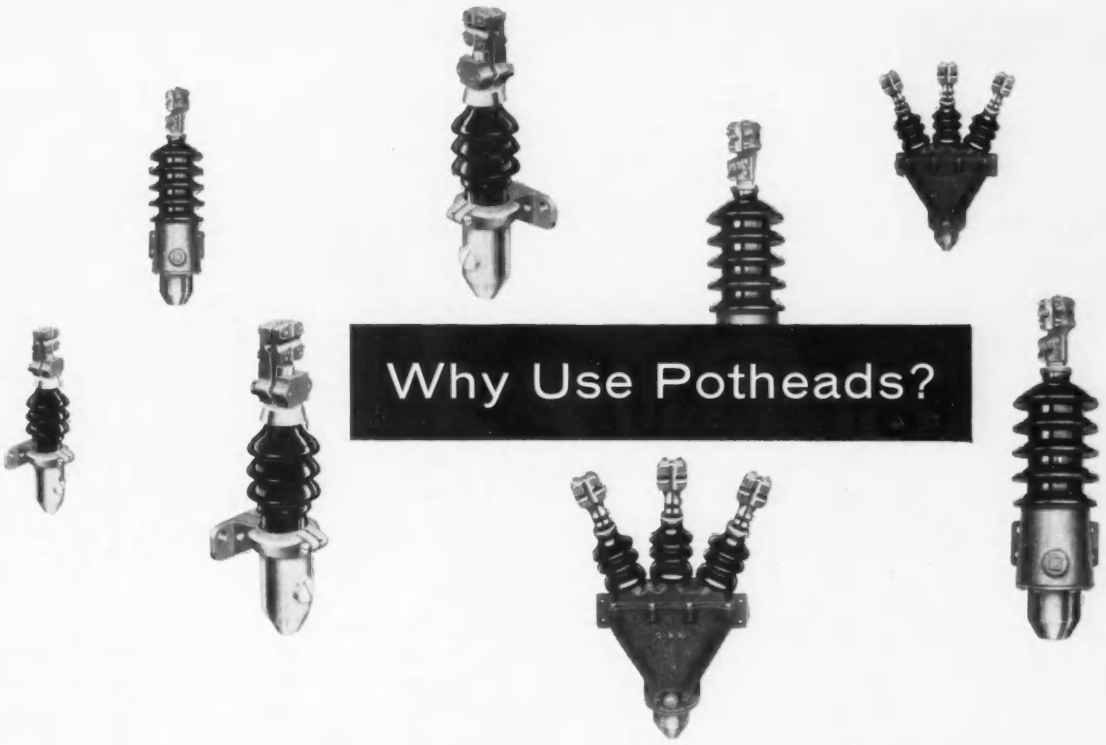
Henry F. Callahan has become a senior vice president of Sylvania Electric Products Inc, General Telephone & Electronics Corp subsidiary.

Callahan assumes full responsibility for lighting products division operations, a responsibility previously held by Frank J. Healy, Sylvania director and a senior vice president. Healy will continue to be responsible for semiconductor division operations and will assist the president in high-level corporate and inter-divisional activities.

With Sylvania for more than 37 years, Callahan has been vice president and general manager of the lighting products division since 1959.

◀ HENRY F. CALLAHAN

(*More News About People on page* 130)



Why Use Potheads?

Because—— Potheads are the best way yet devised to terminate cables.

Why?—— Only a pothead provides a grounded, hermetically-sealed metallic housing over the bare cable for effective protection against weather and corrosive atmospheres. Extra insulation between conductors and to ground is built up in potheads with dielectric materials of high strength, amply protected by the housing against deterioration. Mechanical seal of cable to pothead is excellent, making it easy to secure cable termination solidly.

True—— There are other methods of terminating a cable. These are good and may be entirely adequate for certain conditions. But only a pothead has the extra characteristics that pay off in best service over the years.

What Extras?—— Potheads are best because they have extra features to enhance life, reliability, and continuity of service, while requiring minimum maintenance. They have extra stamina, too, for the difficult situations and for emergencies such as switching and lightning surges, corrosive salt and industrial fumes, and unusual cable-support problems.

G&W—— Standardized potheads covering 80 percent of uses are available for fast off-the-shelf delivery. Other potheads are available for special uses or can be designed for even the most unusual cases. Other types of termination are also available. Write G&W about your problem or contact your nearest sales representative. Data is available on both standard and special-use potheads upon request.

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3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
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superior quality standards — inspired specialized design

A61-1

GUNN

Gunn Appointed VP At Bozell & Jacobs

Bozell & Jacobs, Inc, has named John O. Gunn vice president and director of the agency's investor-owned utilities service division.

Gunn, with Bozell & Jacobs since 1956, has served as account executive for eight major utility clients in the East, South, Midwest, and West, and as the director of special projects for the Electric Companies Public Information Program.

Before coming to Bozell & Jacobs, Gunn served with Cleveland Electric Illuminating Co as manager of public relations and institutional advertising.

REASONER

Reasoner Promoted By Detroit Edison

Harold C. Reasoner has been named director of Detroit Edison Co's general engineering department.

Also in general engineering, Stanley W Luther was made assistant director and Kenneth H. MacLean became chief of system and stations division.

Reasoner has been with Detroit Ed since 1928, except for a six-month period in 1949-'50 when he was on loan as a consultant.

Luther was most recently chief of system and stations division. MacLean was coordination engineer prior to his recent promotion.

PERSONAL BRIEFS

Sargent & Lundy has appointed **William Chittenden** and **Tor Kolflat** as associates. Chittenden is in the electric department, Kolflat in the mechnical department.

Jack V. Richards has been promoted to general manager of Public Service Electric & Gas Co's gas department, and **Clayton S. Cronkright** became general manager, area development.

Richard C. Kelly, construction and maintenance superintendent for Washington Water Power Co, has retired. **John Graham** was named superintendent of WWPCo's Cabinet Gorge hydro plant, replacing **Roy E. Furgason** who retired. **Herbert Roehling** become superintendent of Noxon Rapids plant.

New community development and planning consultant at Potomac Edison System is **John H. Larson.**

Eden F. Jones has become executive secretary of the Delaware Public Service Commission.

Ernest C. Gaston, president of Southern Services, Inc, has succeeded **H. J. Scholz** who resigned as a Southern Co board member.

General Electric Co has established a new operation to centralize its design and development activities in the area of nuclear power sources for specialized applications. **Herman Miller** has been named head of this special purpose nuclear systems operation. **Lemuel R. Boulware,** vice president in charge of employee and public relations, and **Ray H. Luebbe,** vice president and general counsel, have retired and been succeeded by **J. S. Parker** and **L. I. Wood,** respectively.

Richard A. Hammond is the new manager of GE's Pacific Northwest installation and service engineering district, with headquarters in San Francisco. Hammond succeeded **O. A. Gustafson** who retired. In the instrument department, the post of manager-instrument product planning went to **Stanley R. Sulis,** and **Frederick W. Newman** was named product service manager.

G. A. Bradford, consultant-advertising and sales promotion at GE, has been elected a director of the Assn of National Advertisers. Boulware (see above) has been awarded with a special citation from the National Labor-Management Foundation for "his intelligent and courageous approach to labor-management relations."

At GE's Vallecitos Atomic Laboratory, **Eugene W. O'Rorke** has been named manager of the irradiations services operation, and **Eugene T. Hubbard** manager of operations for the test reactor there. **Robert M. Eichner** has become manager-rural electric system and municipal electric utility sales of the electric utility sales operation; **William W. Smith,** manager-marketing in the circuit protective devices department; **A. G. Woodside,** manager-marketing in the instrument department.

Walter W. Green has been promoted to manager-advance product engineering in GE's voltage regulator products section. Managership of manufacturing engineering at the silicone products department went to **Bryce I. MacDonald Jr,** succeeding **Dr E. M. Koeritz** who became manager of manufacturing in the metallurgical products department. **Richard T. Perkins** has assumed the post of manager-foreign business operations at the general purpose control department.

OBITUARIES

Dean Barline, 51, director of Tacoma Department of Public Utilities . . . **William C. Fischer,** 55, sales service manager, Keasbey & Mattison Co . . . **Harry A. Arthur,** 74, former president and director, American Cities Power & Light Corp . . . **Louise Cannon,** secretary and treasurer, Cannon Electric Co . . . **C. E. Frost,** treasurer's department employee in charge of Ohio Edison Co's insurance affairs . . . **Adolph C. Moorhaus,** retired vice president, Cincinnati Gas & Electric Co and Union Light, Heat & Power Co.

North Dakota Power Supply Firms Up

Implementation of the North Dakota Area Power Study (EW, Jan. 2, p 24) moved one step closer when three co-ops—Central Power Electric Cooperative, Dakotas Electric Cooperative, and Minnkota Power Cooperative—signed a statement of intent with two investor-owned utilities, Northern States Power Co and Otter Tail Power Co.

The statement of intent outlines ground rules and objectives of the Dakotas area power program, which calls for 1,250 Mw of new generating capacity by 1975.

The three co-ops have obtained options to buy a plant site on the Missouri River, about three miles below Stanton, N. D., and the majority of a 20,000-acre lignite field near Garrison Dam.

Lignite field test drillings will begin this summer after the five utilities and Paul Weir Co set up test programs. First power plant construction is expected to be a 200-Mw generating plant. Due for 1966 completion, this plant is scheduled to be built by the co-ops who will sell excess power to the investor-owned utilities. A second plant will probably be built by investor-owned utilities, who in turn will sell to the co-ops. Its output will bring total capacity near the 1,250-Mw goal.

One minor problem will be solved before summer when a bill is presented to the North Dakota legislature permitting the three co-ops to band together into a super co-op. The bill will amend present North Dakota law which prevents this, and is expected to pass without difficulty.

According to the statement of intent, local ownership and local control are guiding principles for the Dakota Area plan. It also will permit other power suppliers to join the group at later dates.

Among major objectives set forth in the statement of intent are these:

1. The goal is a long-range, low-cost, dependable power supply, through a program to coordinate the development of this supply.

2. Support of the concept of local ownership and local control of the power supply, with cooperation in the promotion and economic development of the general area.

3. Power pool agreement to include the minimum provisions of interchange of economy energy on a split-saving basis; interchange of emergency energy and firm power; and interchange of energy under long-term contracts so that consideration may be given to installation of peaking plants.

4. Energy from plants built by members of the group may be purchased at the bus bar.

5. Sharing of plant sites will be considered, as will the sharing of construction, operation and ownership of bulk transmission lines, plus the trading of investment in transmission lines and terminal equipment.

6. Coal will be sold or provided from any mines owned by members of the group at prices reflecting costs plus a modest fee.

7. Any differences which may arise will be solved by conference in the spirit of confidence and fair play that has prevailed and which prompted this present undertaking.

Memphis Utility Reveals Quiet Dealings With TVA

The Memphis Light, Gas & Water Division Commission has been secretly negotiating with the Tennessee Valley Authority in hopes of persuading TVA to take over the city's electric generating plant. MLG&W President Ray Morton said that the utility approached TVA last October and proposed that Memphis buy all its power requirements from the giant federal authority. In return, TVA would buy or lease the Memphis power plant and sell power to the city at lower cost.

Morton's statement came in response to criticism of some MLG&W operations made by a citizen's study committee. Of the committee's 26 recommendations, the most important was that the city attempt to have TVA take over Memphis' $150-million power plant. Morton answered that the negotiations were underway, and that some members of the City Commission were aware of this. But they were not made public because "TVA wanted to keep these meetings under their hat until something concrete was worked out."

Crapo

GALVANIZED STEEL STRAND HAS ALL 5

1. Strength
2. Workability
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5. Economy

When you select a size and grade of strand for a specific job you want to know that it meets every requirement of that job. You want ample strength to sustain the ultimate load—plus an adequate safety factor. You want pliability for ease of working in the field. You want ruggedness to withstand the abuse which may be encountered during and after installation. You want long, dependable life. And, you want reasonably low first cost and low maintenance costs.

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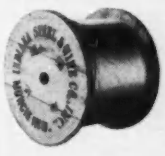

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New Power Source Explored

Fuel Cells—Power for the Future, by graduate students at the Harvard Business School. Published by Fuel Cell Research Associates, P. O. Box 157, Cambridge 38, Mass. 160 pages, illustrated, paperback. Price $18.75.

The possible applications of fuel cells in the coming decade are presented and discussed from a technical and economic viewpoint. All major applications—electric generation in plants, substations, and households, for automobiles, motor boats, industrial equipment, and the chemical industry—are analyzed in a broad but informative manner.

Types and costs of cells as well as fuels are presented for fuel cells and the competing source of energy. Through the use of price trend lines, in some cases to 1980, the authors have indicated when and where fuel cells might become competitive with present types of power generating equipment.

The book, which is directed at engineering as well as management, will help guide electric utility thinking on the impact of fuel cells on future business.

It was written as part of the requirements of the degree of Master of Business Administration. It is unfortunate that the book, bound in a softback cover, is very perishable.

Lists World's Utilities

Electricity Undertakings of the World, 1960-61. Published by Benn Brothers Ltd, Bouverie House, 154 Fleet St, London EC4, England. 648 pages. Price 37s. 6d., delivered ($5.25).

This 70th edition of the world's electric utility concerns is expanded over last year's with the addition of new plants, such as the Trawsfynydd nuclear station in Wales, and of older undertakings previously unreported. As before, this is the definitive listing for the international power picture, especially for the United Kingdom. There are some errors. The reviewer could not find American Electric Power Co or its subsidiaries, and the book's organization has not yet been adjusted to all the recent political changes. But such a work is dependent upon cooperation by the companies it lists, as its editor points out in appealing "to those supply authorities who do not send us details for inclusion."

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Meetings Calendar

MARCH

Southern Safety Conference & Exposition—Atlanta Biltmore Hotel, Atlanta, March 5-7.

National Lighting Exposition—The Coliseum, New York City, March 5-8.

American Society of Mechanical Engineers—Gas Turbine Power Division Conference, Shoreham Hotel, Washington, D. C., March 5-9.

Instrument Society of America—11th Annual ISA Conference on Instrumentation for the Iron and Steel Industry, Roosevelt Hotel, Pittsburgh, March 8-10.

Symposium on Engineering Aspects of Magnetohydrodynamics—Sponsored by AIEE-IAS-IRE-University of Pennsylvania, U of Pa., Philadelphia, March 9-10.

Pennsylvania Electric Association—Residential Committee, Reading, March 13-14; Customer Contact Committee, Monticello, N. Y., March 15; Street and Highway Lighting Committee, Lancaster, March 16-17; Personnel Practices Committee, Pittsburgh, March 23; General and Customer Accounting Committee, Philadelphia, March 23-24.

National Association of Corrosion Engineers—Annual Conference, Statler Hotel, Buffalo, March 13-17.

Edison Electric Institute—Industrial Relations Committee, Mayflower Hotel, Washington, D. C., March 16-17; Meter and Service Committee, Netherland Hilton Hotel, Cincinnati, March 12-15; Sales Conference, Chicago, March 20-21.

Tennessee Valley Public Power Association—Annual Meeting, Hotel Patten, Chattanooga, March 20-22.

Canadian Electrical Association—Western Zone, Empress Hotel, Victoria, B. C., March 20-22.

Institute of Radio Engineers—International Convention, Waldorf Astoria Hotel and the Coliseum, New York, N. Y., March 20-23.

Northwest Public Power Association—Meter School, Oregon State College Campus, Corvallis, Oreg., March 20-25.

American Power Conference—Sherman Hotel, Chicago, March 21-23.

Southeastern Electric Exchange—Annual Conference, Boca Raton Hotel, Boca Raton, March 27-29.

Symposium on Temperature—Sponsored by American Institute of Physics, Instrument Society of America, National Bureau of Standards, Columbus, March 27-31.

Electric Association of Kansas City—Fifth Biennial Electrical Supply Trade Show, Municipal Auditorium, Kansas City, Mo., March 28-30.

APRIL

• **The South Atlantic Wood Utility Pole Conference**—Sponsored by the Wood Products Department of the School of Forestry, North Carolina State College, Raleigh, April 5-6.

• **Northwest Public Power Association**—Annual Membership Meeting, Cascadian Hotel, Wenatchee, Washington, April 5-7.

• **American Institute of Electrical Engineers**—South East District Meeting, Jung Hotel, New Orleans, April 5-7; Rubber and Plastics Industries Conference, Sheraton Hotel, Akron, April 10-11; Extra High Voltage Cable Conference, Mark Twain Hotel, Elmira, April 11-13; Materials Handling Conference, Pick-Congress Hotel, Chicago, April 11-12; Electric Heating Conference, Sheraton-Lincoln Hotel, Indianapolis, April 11-12; Electric Welding, Commodore Hotel, New York City, April 17-21; Cement Industry Technical Conference, Sheraton-Cadillac Hotel, Detroit, April 18-20; Great Lakes District Meeting, Hotel Pick-Nicollet, Minneapolis, April 19-21.

• **American Society of Mechanical Engineers**—Management Engineering Conference, Statler Hilton Hotel, New York City, April 6-7; ASME Oil & Gas Power Conference & Exhibit, Jung Hotel, New Orleans, April 9-13.

• **Michigan Municipal Utilities Association**—Spring Conference, Wenonah Hotel, Bay City, Michigan, April 6-7.

• **Pacific Coast Electrical Association**—Engineering & Operating Conference, Ambassador Hotel, Los Angeles, April 6-7; Business Development Conference, Sheraton-Palace Hotel, San Francisco, April 17-18; Administrative Services Conference, Villa Hotel, San Mateo, April 27-28.

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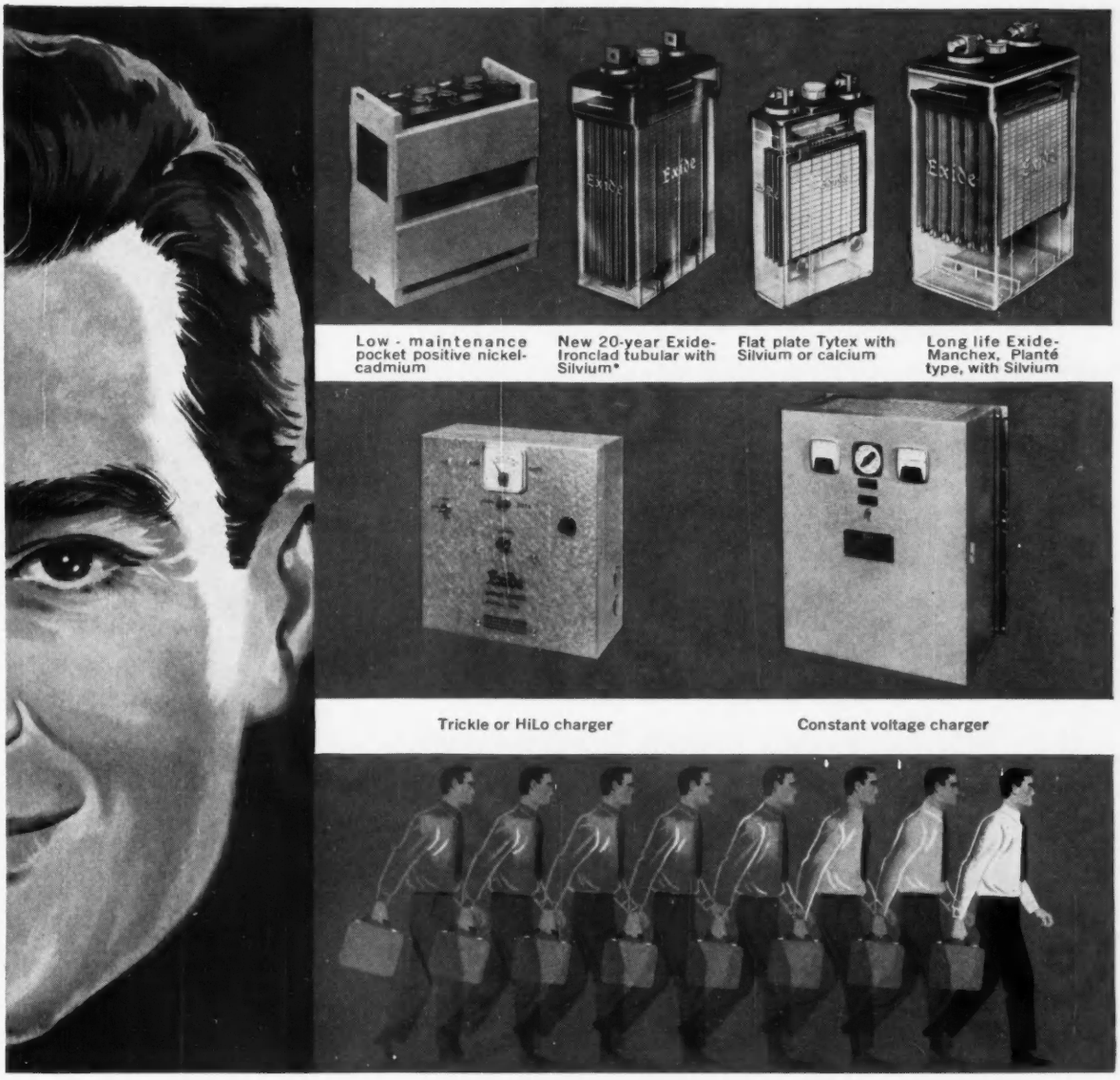
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